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RESULTS WITH BULL SEMEN STORED AT −79° C.

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New developments in artificial insemination were made possible by the discovery at Mill Hill that bull spermatozoa in glycerol-containing media withstood freezing at −79° C. (Smith & Polge, 1950). Preliminary experiments at Shinfield and Cambridge on the fertilising capacity of frozen bull semen met with limited success, only one calf being produced (Stewart, 1951). It was not until December, 1951, during further work at Cambridge, that progress was made in the practical application of the original discovery. At this time the technique for freezing semen was altered, with the result that out of 38 cows inseminated with semen which had been frozen by the new method 30 were found to be in calf when examined for pregnancy six weeks later. Details of the freezing technique which gave these promising results were published in April, 1952 (Polge & Rowson, 1952a, b). Full results of this experiment up to the time of calving are now available. Of the 30 pregnant cows, two died and one which was sold could not be traced. Twenty-four of the remaining 27 calved normally, producing 14 heifer calves and 11 bull calves (including one pair of twins). All these calves were strong, healthy and normal in every way. Three cows slipped calf, one at two months and two at five months ; one of these was carrying triplets and the other had a history of damage. The five-month foetus was recovered and no pathogenic organisms were found.

With the small number of cows involved, the abortion rate in this experiment cannot be considered excessive. On the other hand, it has been clearly shown that normal calves are born to cows inseminated with semen which has been frozen at −79° C.

The experiment reported above relates to semen which was diluted with glycerol-containing medium at a rate of 1 : 4 and kept frozen for periods of one to eight days. The chief object of freezing the semen, however, was to keep it for very long periods. Glycerol-treated semen was therefore frozen and kept at −79° C. in a specially constructed cabinet modified from the design described by Polge & Lovelock (1952). Samples have been thawed at intervals and used for insemination. The results up to date (see Table I) show no falling off in fertilising capacity after 32 weeks at −79° C.

Semen for artificial insemination is generally used in high dilutions. Table II gives preliminary results of inseminations with samples diluted up to 1 : 40 and kept at −79° C. There is no indication of impaired fertility with any of the dilutions.

TABLE I

LONG-TERM STORAGE OF BULL SEMEN AT −79° C.
(Dilution 1 : 4)

Age of semen (weeks)	No. of cows	Conception rate* (per cent.)
1– 4	16	63
5– 8	16	69
9–12	16	81
13–16	16	63
17–20	16	50
21–24	16	81
25–28	16	56
29–32	16	75
	Average conception rate	69

* Half the cows in the groups up to 28 weeks have been examined for pregnancy. The remaining cows have not returned to oestrus within three months from insemination. In the group 29–32 weeks the conception rate figure represents non-returns at two months.

TABLE II

SEMEN FROZEN AT DILUTIONS 1 : 10 TO 1 : 40
(Maximum age of semen 10 days)

Degree of dilution	No. of cows	No. pregnant*
1 : 10	12	6
1 : 20	11	7
1 : 30	11	9
1 : 40	11	7

* All cows have been examined for pregnancy by rectal palpation.

A total of 285 cows have so far been inseminated with semen diluted to different degrees and stored at −79° C. for varying periods. The conception rate (three months non-return) is 66·3 per cent.

The progress of these experiments suggests that the use of " deep-frozen " semen will have important applications in the future development of cattle breeding. A nominated service scheme with frozen semen has already been established and export of semen from pedigree bulls should soon be practicable. Meanwhile, fundamental studies on freezing spermatozoa are being continued at the National Institute for Medical Research as part of a wider programme to investigate the effects of very low temperatures on a variety of living cells and tissues.

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XUM

VAGINAL EVERSION IN THE PREGNANT EWE

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INTRODUCTION

Vaginal eversion occurs in all the domestic animals, and in the ewe it has been reported in the United Kingdom, Australia, New Zealand, Europe, America and Iceland.

It is variously known as " bearing trouble," " red bag," " showing the rede," " throwing the rose," " bearings," " wethering," " pushing out the button," and no doubt by other picturesque local names.

Little is known of its incidence in sheep. In New Zealand in 1935 when the condition was more prevalent than usual, a survey conducted on 19 farms revealed an incidence varying from 1 to 8 per cent. The flocks investigated were Romney Marsh, Southdowns, Romney-Lincolns and Romney-Southdowns, and vaginal eversion seemed equally common among each (Bayly, Hankin & Haugh, 1936).

Laing (1945) reported that the average incidence in some districts in New Zealand may amount to 4 per cent., with a highest incidence of 11 per cent. He considered the Romney Marsh susceptible, the Southdown practically immune and the Cheviot, Merino and Ryeland breeds immune (Laing, 1949).

The disease occurs mostly in pregnant ewes in good condition, more often in second or later pregnancies, more frequently in multiple pregnancies, and usually within the fortnight before lambing. It may, however, develop in pregnant and non-pregnant ewes of all ages and in any condition (Bayly and others, 1936; Laing, 1945). Belschner (1950) stated that the condition usually occurred about seven days before lambing and that the ewes affected were generally three years old or over and in fat condition.

Both Bayly and others (1936) and Laing (1945, 1949) considered ewes with a roomy pelvis were more susceptible.

It is believed that once a ewe has developed eversion of the vagina, the condition will recur at a subsequent lambing (Laing, 1949).

Richter and Götze (1950) defined three degrees of the disease which they called simple inversion, incomplete prolapse and complete prolapse. They reported that with suitable treatment cases of inversion or incomplete prolapse often recovered, but that this seldom occurred with complete prolapse.

Laing (1945) stated that spontaneous reduction of the protruded organ sometimes occurred, especially in non-pregnant ewes, but that about half the affected ewes died or had dead lambs.

Replacement of the protruded organ is the usual method of treatment. (Bayly and others, 1936; Laing, 1945; Richter & Götze, 1950; Belschner, 1950.)

Koch and Haisch (1943) claimed to have successfully treated affected pregnant and non-pregnant cows, with chorionic gonadotrophin of pregnancy urine (Prolan).

Farquarson (1949) recommended a plastic operation for treatment of the condition.

Outbreaks have occurred in flocks grazing pastures in which growth was rank following a mild wet autumn and winter; in flocks on a diet containing much fibre; after prolonged turnip feeding; or when poorly fed ewes were transferred on to good feed (Bayly and others, 1936; Laing, 1945).

Bayly and others (1936) recorded that in Marlborough South, New Zealand, the incidence increased during five dry years when the pasture deteriorated and ryegrass, cocksfoot and clover mixtures were replaced by danthonia. When the pastures subsequently improved due to increased rainfall, the disease again became less common. They also reported cases developing up to several months after apparently normal lambings.

Fraser (1950) stated that vaginal prolapse was almost epidemic among half-bred (Border Leicester × Cheviot) ewe flocks in the Border counties of Scotland, generally where turnips were fed in large amounts.

Bennetts and others (1946) observed that uterine prolapse in ewes in Australia was associated with the grazing of pastures consisting almost entirely of subterranean clover which contained oestrogenic substances. Such substances have also been identified in pasture herbage in England (Bartlett and others, 1948).

Koch and Haisch (1943) and Richter and Götze (1950) concluded that vaginal prolapse falls within the group of diseases due to hormonal imbalance.

Garm (1949) recorded the occurrence in nymphomaniac cows of vaginal prolapse which he considered might be due to atony of the pelvic tissues associated with high levels of circulating oestrogens. The incidence of nymphomania was highest after one or two pregnancies, and Garm thought the unstable endocrine balance of these animals had become an imbalance, due to the strain of high lactation, and that this constitutional endocrine weakness was hereditary.

Richter and Götze (1950) thought the cause of vaginal eversion had probably a genetical basis which was expressed as a hormonal imbalance at the end of pregnancy. They considered increased intra-abdominal pressure, or anything which caused the animal to press, might also be contributory factors.

Koch and Haisch (1943) also thought a hormonal imbalance was the cause of the disease in cows, and found that it tended to occur in closely related animals, so that heredity might play a part.

Laing (1949) considered the condition to be caused by relaxed tissue around the vaginal passage giving way to straining possibly due to a distended bladder, or to abdominal pressure. Some success in control is claimed for gentle daily exercise of pregnant ewes.

In Iceland, where pregnant ewes are housed, it is considered that the incidence of the condition is reduced by allowing the rear part of the standing to become built up with dung (Palsson, 1950).

The disease is most common in women of menopausal age, when the pelvic tissue supports of the genital organs become slack (Shaw, 1941).

Chavance (1944) considered vaginal prolapse in the cow and ewe to be a manifestation of rachitic tendencies due to the failure of muscle tone, and advocated treatment with vitamin D.

Lambranzi (1938) thought some cases of vaginal prolapse in the non-pregnant cow to be due to lack of tone of the vagina caused by a persistent corpus luteum.

All the authorities quoted seem agreed that there is no indication that the disease is infectious or contagious.

It appears therefore that outbreaks of vaginal eversion in the ewe may be associated with nutritional causes, which may affect endocrine balance; that an hereditary anatomical or endocrine weakness may be involved; and that loss of tone of the vaginal attachments is concerned, which is more common in older animals after a number of parturitions. Increased intra-abdominal pressure and factors which cause an animal to press may also be contributory causes.

(A). Incidence of Vaginal Eversion in Pregnant Ewes in a Sample Group of Flocks in England

As little was known of the incidence of vaginal eversion in pregnant ewes in Great Britain, a study of this was made in a group of flocks in England, during the lambing seasons 1950 and 1951.

Experimental.—Contact was made with flockmasters through members of the staff of the School of Agriculture, Cambridge, and the secretaries of some breed societies nominated others likely to co-operate in such an investigation. By these means, 34 flocks were included in the survey; one of these withdrew after the first season.

The flocks were situated in the following counties:—

Cambridgeshire	11
Kent	8
Suffolk	5
Northamptonshire	3
Hertfordshire and Yorkshire	2 each
Norfolk, Bedfordshire and Northumberland ...	1 each

In 29 cases personal contact was made with the flockmaster and/or the shepherd, and in all cases correspondence was exchanged. Addressed postcards were supplied for advising of the occurrence of each case, and, where possible, ewes exhibiting vaginal eversion were seen.

At the end of the lambing season, details were obtained for each flock on a form as illustrated in Fig. 1.

Breed(s).
No. of breeding ewes in each breed.
No. of 1st pregnancy ewes.
No. of 2nd pregnancy ewes.
Month(s) when most lambs born.
No. of cases of vaginal eversion.

Cases	1	2	3	4	5	6
Month when case occurred						
Days before lambing when showed...						
or						
„ after „ „ ...						
Ewe 1st, 2nd or later pregnancy ...						
„ carrying one or more lambs ...						
„ alive						
„ died before lambing						
„ „ at „						
„ „ after „						
Lambs born alive						
„ dead						

Fig. 1.—Form for obtaining information on the incidence of vaginal eversion in pregnant ewes.

Where it was considered of value, the results were analysed statistically by the square contingency table method (Fisher, 1948).

As the information was not obtainable from flockmasters, the proportion of single and multiple pregnancies in the sample group was calculated from figures for various breeds and crosses compiled by Nichols (1924, 1926).

Results.—Of the 21,660 breeding ewes in the sample group for the two seasons of the study, 115 developed vaginal eversion which represents an incidence of 0·53 per cent. (Table I).

Vaginal eversion occurred in 13 breeds or crosses in the sample group. In the seven breeds or crosses in which the condition did not occur, the total numbers represented were relatively low, ranging from 364 down to 50 (Table I).

Variation between the two seasons for both breeds and individual flocks was slight, except for the Kerry Hill flock (No. 17) in which a statistically highly significant variation occurred (Table III, items 1, 2 and 3), due to an outbreak in the second season when 6 per cent. of the ewes developed vaginal eversion (Table II). The circumstances of this and other outbreaks are discussed later.

Vaginal eversion was much more common in later pregnancies (Table III, item 8; Table IV) and much more likely with multiple births (Table III, item 9; Table V).

The condition appeared less likely to occur as the lambing season advanced (Table III, item 10; Table VI).

It was found that nearly half the ewes died which developed the condition, and one-third of the lambs carried by these ewes also died (Table VII).

Cases occurred up to eight weeks before and sometimes a few days after parturition, but 70 per cent. of the vaginal eversions appeared within the last two weeks of pregnancy (Table VIII).

Over the two years, five cases were reported in ewe lambs.

In about 50 per cent. of the flocks in the sample group, no cases occurred, and in only about 16 per cent. was the incidence more than 1 per cent. (Table IX).

Most farmers eliminate from their flock any ewes which have developed vaginal eversion. Only two cases from lambing season 1950 were retained in the sample group, and both these ewes lambed without trouble in 1951.

Table I

Incidence of Vaginal Eversion in Sample Group of Breeding Ewes in England in Lambing Seasons 1950 and 1951

Breed or cross	Numbers			Cases of vaginal eversion			Frequency within breeds, per cent.
	1950	1951	Total	1950	1951	Total	
Suff. ...	3,376	3,356	6,732	21	12	33	0·5
R.M. ...	3,056	3,015	6,071	14	20	34	0·6
B.L. × C. ...	1,319	1,310	2,629	1	2	3	0·1
Sthd. ...	640	647	1,287	3	—	3	0·2
Suff. × C. ...	314	301	615	—	1	1	0·2
B.L. ...	369	235	604	5	—	5	0·8
K.H. ...	240	273	513	—	16	16	3
E.L. ...	160	320	480	1	—	1	0·2
H.D. ...	286	160	446	2	2	4	0·9
E.L. × Suff.	140	273	413	2	6	8	1·9
O.D. ...	205	200	405	2	2	4	1
C.	164	200	364	—	—	—	—
W.	185	94	279	—	1	1	0·4
B.L. × W. ...	109	162	271	1	1	2	0·7
B.L. × Suff.	—	170	170	—	—	—	—
D.H. × Sthd.	109	—	109	—	—	—	—
Sw. ...	—	100	100	—	—	—	—
D.H. × W.	41	24	65	—	—	—	—
Sthd. × Suff.	—	57	57	—	—	—	—
D.H. ...	—	50	50	—	—	—	—
Totals for sample group							
20 breeds and crosses ...	10,763	10,897	21,660	52	63	115	0·53

B.L. = Border Leicester.
C. = Cheviot.
D.H. = Dorset Horn.
E.L. = English Leicester.
H.D. = Hampshire Down.
K.H. = Kerry Hill.
O.D. = Oxford Down.
R.M. = Romney Marsh.
Sthd. = Southdown.
Suff. = Suffolk.
Sw. = Swaledale.
W. = Welsh.

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TABLE II
INCIDENCE OF VAGINAL EVERSION IN EACH FLOCK OF SAMPLE GROUP

Flock No.	Breed	1950		1951	
		No. ewes	No. cases	No. ewes	No. cases
1	B.L. × C.	397	Nil	555	1
2	Suff.	600	"	580	Nil
3	R.M.	610	3	580	3
4	Suff.	320	1	300	Nil
5	"	200	Nil	197	"
6	"	170	"	180	2
7	"	240	"	240	Nil
8	B.L. × C.	200	"	200	"
	Suff. × C.	314	"	301	1
9	Suff.	400	9	300	4
10	R.M.	1,100	Nil	1,100	Nil
11	"	300	3	258	"
12	"	320	3	320	4
13	"	240	Nil	280	3
14	"	112	1	108	1
15	"	250	Nil	225	Nil
16	"	94	"	120	4
	B.L. × Suff.	168	"	170	Nil
17	B.L. × C.	139	1	—	—
	K.H.	240	Nil	273	16
18	H.D.	286	2	140	Nil
	B.L. × C.	—	—	140	1
19	Suff.	50	Nil	30	Nil
	B.L.	20	"	15	"
	B.L. × C.	160	"	175	"
20	Suff.	260	1	260	"
	H.D.	—	—	20	2
21	O.D.	205	2	200	2
22	Suff.	214	1	189	Nil
23	"	300	Nil	350	"
24	Sthd.	200	"	200	"
25	"	63	3	66	"
	D.H.	50	Nil	—	—
	Sthd. × D.H.	109	"	—	—
	Suff.	—	—	50	Nil
	Sthd. × Suff.	—	—	57	"
26	Sthd.	77	Nil	81	"
	Suff.	103	"	110	"
27	Sthd.	300	"	300	"
	Suff.	200	2	200	1
28	E.L.	160	1	160	Nil
	E.L. × Suff.	140	2	123	6
29	Suff.	280	7	260	5
	E.L.	—	—	160	Nil
	E.L. × Suff.	—	—	150	"
30	B.L.	115	Nil	120	"
	C.	164	"	200	"
	B.L. × C.	255	"	240	"
31	B.L. × W.	109	1	162	1
	D.H. × W.	41	Nil	24	Nil
	Suff.	39	"	—	—
	W.	185	"	94	1
32	B.L.	180	"	100	Nil
	Swaledale	—	—	100	"
33	B.L.	54	5	—	—
34	R.M.	30	4	24	5

B.L. = Border Leicester. O.D. = Oxford Down.
C. = Cheviot. R.M. = Romney Marsh.
D.H. = Dorset Horn. Sthd. = Southdown.
E.L. = English Leicester. Suff. = Suffolk.
H.D. = Hampshire Down. W. = Welsh.
K.H. = Kerry Hill.

TABLE IV
RELATIVE MATURITY OF BREEDING EWES IN SAMPLE GROUP OVER BOTH SEASONS

Pregnancy	Total ewes in sample group	Ewes developing vaginal eversion	Frequency in each group (per cent.)
1st ...	5,991	15	0·25
2nd ...	5,122	21	0·41
Later ...	10,547	79	0·75

TABLE III
STATISTICAL ANALYSES OF SURVEY DATA ON VAGINAL EVERSION IN PREGNANT EWES

Item	Variation examined	Statistical result
1	Between seasons within breeds ...	$\chi^2_{13} = 19{\cdot}180$ (N.S.)
2	Between seasons within flocks ...	$\chi^2_{24} = 22{\cdot}596$ (N.S.)
3	Between seasons for the Kerry Hill flock (No. 17)	$\chi^2_{1} = 14{\cdot}518$ ***
4	Between flocks within breeds (over both seasons) for the Border Leicester × Chev. breed	$\chi^2_{5} = 9{\cdot}622$ (N.S.)
5	Ditto Suffolk breed	$\chi^2_{12} = 32{\cdot}64$ **
6	Ditto Romney Marsh breed ...	$\chi^2_{8} = 277{\cdot}09$ ***
7	Between breeds (over both seasons)...	$\chi^2_{19} = 103{\cdot}165$ ***
8	Between 1st, 2nd and later pregnancies	$\chi^2_{2} = 19{\cdot}822$ ***
9	Between single and multiple births...	$\chi^2_{1} = 37{\cdot}70$ ***
10	Between months when eversion occurred	$\chi^2_{3} = 13{\cdot}381$ **

(N.S.) = Not significant.
** = Significant at the 1 per cent. level or significant.
*** = " " 0·1 " " highly significant.

TABLE V
COMPARISON OF SINGLE AND MULTIPLE BIRTHS FOR BOTH SEASONS IN SAMPLE GROUP OF EWES

No. of lambs carried	Ewes which developed vaginal eversion	Total No. of ewes in sample group	Frequency (per cent.)
One	34	13,383	0·2
More than one ...	70	8,277	0·8
Not known ...	11	—	—

TABLE VI
MONTHLY INCIDENCE OF LAMBING AND OF VAGINAL EVERSION IN SAMPLE GROUP OF EWES

Month	Lambing in whole group			Appearance of vaginal eversion			Frequency (per cent.)
	1950	1951	Total	1950	1951	Total	
January	1,293	1,191	2,484	12	12	24	1·0
February	2,249	2,134	4,383	15	9	24	0·5
March	4,106	4,143	8,249	17	24	41	0·5
April	3,115	3,429	6,544	7	16	23	0·35

TABLE VII
DEATHS ASSOCIATED WITH VAGINAL EVERSION IN THE SAMPLE GROUP, OVER BOTH SEASONS

Animals	No. of deaths	Total No. involved	Per cent. of total involved
Ewes	50	115	43
Lambs born dead 46 dead *in utero* 18	64	194	33

TABLE VIII
OCCURRENCE OF VAGINAL EVERSION IN RELATION TO PARTURITION

Week in relation to lambing	Number of cases		
	1950	1951	Total
8th week before...	—	2	2
7th " ...	—	2	2
6th " ...	—	1	1
5th " ...	—	1	1
4th " ...	1	3	4
3rd " ...	7	5	12
2nd " ...	18	23	41
Last " ...	19	18	37
At lambing ...	1	1	2
1st week after ...	5	8	13

TABLE IX
VARIATIONS IN INCIDENCE OF VAGINAL EVERSION BETWEEN FLOCKS AND BETWEEN SEASONS IN THE SAMPLE GROUP

Incidence (per cent.)	Number of flocks	
	1950	1951
Nil	16	15
Up to 1	13	12
1–2	3	4
6	—	1
11	1	—
12	1	—
20	—	1

Discussion.—With regard to the condition of vaginal eversion, the group of flocks may be considered a representative sample. The only selection practised was on the basis of flockmasters willing to co-operate in the investigation and the data presented are based on information supplied by these flockmasters.

It appears that breeds vary in their liability to the condition, but it is considered more likely that the variation is due to differences between individual flocks within breeds (Table III, items 4, 5, 6 and 7). This suggests that the condition is caused by hereditary or environmental factors or a combination of both, as they affect an individual flock.

In those breeds in which the condition did not occur and in which the numbers represented were relatively low, cases might well have appeared if more ewes of these breeds had been included in the sample group.

The finding of a higher incidence in later pregnancies and in multiple births confirms an earlier report by Laing (1945).

The proportion of deaths associated with the condition approximates those found in New Zealand (Laing, 1945).

The appearance of 70 per cent. of the cases in the last two weeks of pregnancy is in agreement with another observation of the same worker.

(B). AN EXAMINATION OF THE CIRCUMSTANCES OF OUTBREAKS OF VAGINAL EVERSION IN PREGNANT EWES

A number of outbreaks of the condition have been encountered both within and outside the sample group, and notes have been made of the circumstances of each in the hope that some light might be thrown on the aetiology of the disease. I am indebted to the flockmasters and shepherds and in two cases to the veterinary surgeon concerned for the details made available.

Outbreak 1.—In 1949, 30 cases occurred within the last three weeks before lambing, in a flock of 280 Suffolk ewes in their first pregnancy. The ewes were in good, but not fat, condition, and were folded throughout pregnancy on sugar beet tops, which lay where they had been cut from the roots. On the same farm was a flock of 400 Border Leicester × Cheviot ewes on ley pastures, in which no cases occurred. As the Suffolk flock was sold, it was not possible to follow its subsequent history.

Outbreak 2.—In 1950, of 54 Border Leicester ewes in their first pregnancy five were affected within the two weeks before lambing. The flock was on moderate grass, was allowed some concentrates, and the animals appeared in reasonable condition.

Outbreak 3.—In 1950, 12 were affected of 200 Clun type ewes. They were fed on swedes, mangolds and sugar beet tops, were run on pasture, and were also given medium quality hay. The animals were in moderate condition and cases occurred only when sugar beet tops were being fed. All ages of ewes were affected.

Outbreak 4.—In 1950, 13 ewes in second or later pregnancies developed the condition, out of a flock of 450 Hampshire Down ewes. The cases occurred up to six weeks before lambing. The animals were fat, although folded over poor sward, mostly withered, but showing tufts of fescue and ryegrass. One mangold and about 3 lb. of hay per day were allowed for each animal. Subsequently there were many difficult lambings in the flock, associated with failure of the cervix uteri to relax.

Outbreaks 5 *and* 6.—Of a small flock of 30 Romney Marsh ewes, in 1950, four in their second pregnancy developed the condition and died. In 1951, of 24 of the same flock two first pregnancy and three later pregnancy ewes were affected. There are cases each year in this small flock, which is closely bred. The sheep were run on grass, and had as supplementary feed, mangolds, hay and concentrates. Some of the ewes were fat, but cases were not confined to these.

Outbreaks 7 *and* 8.—In 1951, 16 cases occurred in 273 Kerry Hill ewes, all in their third or later pregnancy. This incidence of 6 per cent. happened during the last two weeks of pregnancy. The flock was fed on sugar beet tops, was turned on to grass for part of the day, and received ½ lb. of concentrates per ewe per day. The ewes were in good condition but not fat. Many other ewes in the flock bore putrefying lambs. On the same farm in 1950, there was only one case of vaginal eversion, but in 1949, 10 per cent. of a flock of 130 Border Leicester × Cheviot ewes developed the disease. The method of feeding was similar to that of 1951; there was no record of the birth of putrefying lambs in 1949.

Discussion.—In these eight outbreaks, in which the incidence ranged from 3 to 20 per cent., and the numbers of affected ewes from 4 to 30 in a flock, there was considerable variation in breed, age, bodily condition and husbandry of the affected ewes. There is a possibility that feeding of sugar beet tops in excess may be conducive to outbreaks of vaginal eversion, but it is difficult to find a

possible cause of the condition which is common to all the outbreaks. With regard to vaginal eversion in the cow, Koch and Haisch (1943) concluded for the same reason that environmental factors were unimportant.

Outbreaks 5 and 6 offer some evidence for the influence of hereditary factors as a cause of the disease.

(C). Examination of a Treatment of Vaginal Eversion in Pregnant Ewes

In view of the success claimed by Koch and Raisch (1943) for treatment of the disease in cows by the subcutaneous injection of 250 to 1,000 I.U. of prolan, this method was applied in eight cases in ewes.

Material and Methods.—The cases occurred within the sample group and consisted of three Southdown and five Suffolk ewes, on three different farms, the eversions appearing within the last fortnight of pregnancy.

The injection of 500 I.U. chorionic gonadotrophin (Prolan; Bayer Products Ltd., London, W.C.2) was made in each case subcutaneously in the axilla.

No other treatment was applied to these ewes.

Results.—In no case did the eversion disappear before lambing, and there was no indication that the treatment is of value in the ewe (Table X).

Table X

Results of Administration of Prolan to Ewes with Vaginal Eversion

Case No.	Breed	Time of appearance before injection (days)	Results
1	Southdown	3	Lambed twins six days after injection. Eversion persisted. Ewe died two days later.
2	„	4	One dead lamb seven days after injection. Eversion disappeared after lambing.
3	„	4	Lambed twins five days after injection. Eversion disappeared after lambing.
4	Suffolk	3	Lambed dead twins nine days after injection. Eversion disappeared after lambing.
5	„	3	Eversion continued. Ewe died before lambing, four days after injection.
6	„	3	Lambed twins nine days after injection. Eversion disappeared after lambing.
7	„	4	Lambed single four days after injection. Eversion persisted. Ewe died two days later.
8	„	3	Lambed dead single 10 days after injection. Eversion persisted. Ewe died next day.

(D). The Induction of Vaginal Eversion in Experimental Ewes

To attempt to induce the disease in experimental ewes it was decided to maintain a high oestrogen blood level in these animals, some of which would be maintained in good, and some in poor condition.

Materials.—Thirty-six non-pregnant ewes were obtained all of which had had at least two pregnancies, and were therefore considered more susceptible to vaginal eversion. They consisted of 16 Welsh, 10 Romney Marsh, eight Border Leicester × Welsh, and two Dorset Horn × Welsh ewes.

Diethyl-stilboestrol (hereafter called stilboestrol) (Boots Pure Drug Co. Ltd., Nottingham) was implanted in tablet form, without excipient. Stilboestrol was used in powder form for oral administration.

Pitocin (Parke, Davis and Co., Hounslow) contained 10 international oxytocic units per c.c.

Method.—The thirty-six ewes were divided into two groups each containing eight Welsh, five Romney Marsh, four Border Leicester × Welsh, and one Dorset Horn × Welsh.

One group was allowed unlimited hay, oats and linseed cake. The other group was restricted to 2 lb. of oat straw per ewe per week. The ewes were weighed fortnightly, and when a very fat and a very poor bodily condition respectively was attained, feeding was adjusted as required to maintain these weights. Each ewe was fed from an individual manger by being fastened at feeding times by a leather collar round its neck.

In each group of 18 ewes, stilboestrol was administered to 12, the remaining six ewes being controls.

Implantations of 40 15 mg. tablets of stilboestrol were made in the dorsal part of the inner aspect of the hind limb.

After four months, another similar implantation was made into the other hind limb, and the oestrogen intake was again boosted, after a further three months, by the administration by mouth of 25 mg. stilboestrol daily, in a gelatine capsule, for a period of two months.

The treated ewes were therefore receiving stilboestrol over a period of nine months.

At the end of this period to increase the intra-abdominal pressure, a leather belt was fastened tightly round the abdomen of seven stilboestrol-treated and two untreated ewes for periods of one to two weeks.

Fifteen I.U. pitocin were injected into the jugular vein of nine stilboestrol-treated and five untreated ewes.

Results.—In response to the injection of pitocin, one Border Leicester × Welsh ewe commenced to press, and movements of the perineal region were followed, 12 minutes after injection, by partial eversion of the vagina. This ewe was in poor condition, stilboestrol treated, and the abdominal belt was applied during the seven days before the pitocin injection. The eversion persisted for some weeks until the animal was slaughtered.

Although all the injected ewes responded to pitocin with varying degrees of perineal movement and sometimes with defaecation and urination, no others developed vaginal eversion.

Discussion.—Several signs, which are discussed later, indicated that in the treated animals, a high level of circulating oestrogens existed. No vaginal eversion resulted from this endocrine state alone.

No vaginal eversion resulted from abnormal bodily condition alone; from abnormal bodily condition together with high blood oestrogen; from abnormal bodily condition, high blood oestrogen and increased intra-abdominal pressure; or from these last three plus the pitocin injection.

The vaginal eversion exhibited by the one ewe was induced by the pitocin injection, but not by that alone, as 13 other ewes received similar injections without the same result. This suggests, however, that any factor causing uterine contractions or pressing in the perineal region may precipitate the disease, if other conditions are favourable.

As eight other ewes were similarly treated it appears that there was in this ewe some inherent susceptibility to the condition, which the subsequent treatment may or may

not have aggravated, and which the pitocin injection finally revealed.

It is possible, but seems less likely, that in this ewe just the correct degree of hormonal imbalance was found to cause vaginal eversion, and that this was not achieved in the other animals.

That intra-abdominal pressure had some effect possibly before, and certainly after, the initial eversion is indicated by the greater protrusion of the everted mass when the experimental ewe and other ewes seen in the field were lying or trotting and thus increasing the intra-abdominal pressure.

(E). Some Effects of Stilboestrol Treatment in Ewes

(I). *Behaviour.*—All the stilboestrol-treated ewes exhibited nymphomaniac behaviour in varying degrees, at times mounting other ewes or being mounted. There was also a tendency for the sexual behaviour to become masculine. The ewes would tease each other, would sometimes paw the ground, and butt each other or even the attendant who fed them.

McKenzie and Terrill (1937) have recorded mounting and teasing in oestrogen-treated ewes, and Hammond and Day (1944) observed aggressive behaviour in a stilboestrol-treated heifer, which pawed the ground.

Mounting during oestrum is rare in the ewe but may be considered an extension of the normal behaviour pattern, as it occurs normally in the cow. The other signs described appear, however, masculine in nature.

(II). *The Adrenal Cortex.*—In view of the masculine behaviour observed, the secretion of androgens by the adrenal cortex was suspected.

The adrenal glands were recovered at slaughter, and sections were stained with Sudan Black.

The adrenal cortices of the treated animals contained more lipoid material (stained black) than did those of the untreated ewes. A typical example of each is shown in Fig. 2.

It appears possible that oestrogen treatment may stimulate the adrenal cortex, either via the pituitary or indirectly, to secrete androgens. Garm (1949) described changes in the adrenal cortex of nymphomaniac cows, associated with a high level of urinary neutral steroids, but demonstrated no increase of lipoid in the adrenal cortex.

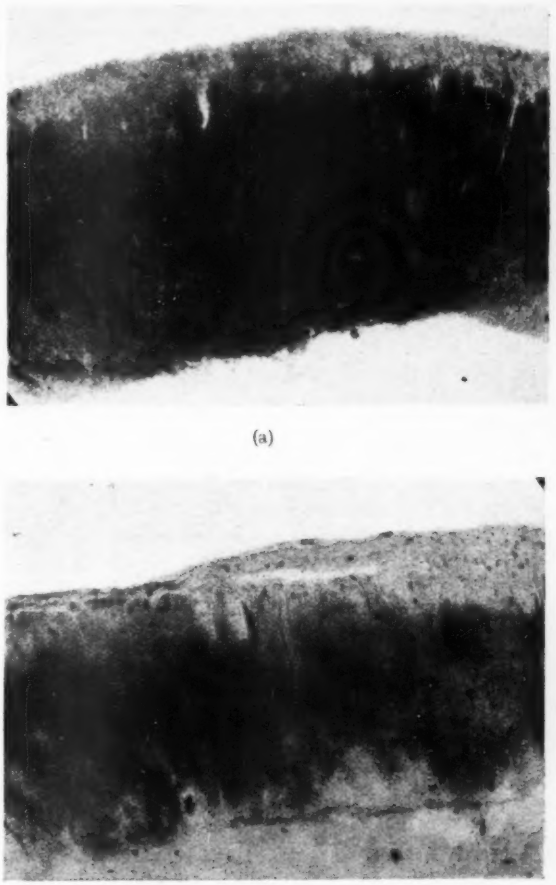
(III). *The Nasal Mucous Membrane.*—All the ewes receiving stilboestrol by mouth exhibited in some degree an inflammatory reaction of the nasal mucosa accompanied by a mucoid discharge. Although the effect was more marked in those animals in which stilboestrol was both implanted and administered orally, it was not seen as the result of implants alone.

(IV). *The Mammary Gland.*—The udder of every stilboestrol-treated ewe increased in size, and milk was expressed from each teat. There was, however, considerable variation in this response.

This phenomenon has been described in the stilboestrol-treated cow (Folley & Malpress, 1944; Hammond & Day, 1944), and in the ewe grazing herbage containing oestrogenic substances (Bennetts, 1949).

(V). *The Pelvic Region.*—As a result of the administration of stilboestrol by implant or by mouth, changes occurred in the pelvic region in every case although the degree of response varied.

Relaxation of the sacro-sciatic and sacro-iliac ligaments caused a depression each side of the tail with a looseness of the skin in the region. There was abnormal movement of the pelvic bones, resulting sometimes in crepitus-like sounds. The tissues were dissected from the pelvic girdle of one stilboestrol-treated ewe, and it was found that considerable movement was possible at the pubic symphysis and the sacro-iliac joints.



(a)

(b)

Fig. 2.—Comparison of adrenal cortices from a stilboestrol-treated and an untreated ewe. Lipoidal material stained with Sudan Black. × 22. (a) Stilboestrol-treated ewe. (b) Untreated ewe.

The tail head (the caudal extremity of the sacrum) was elevated in some cases.

Similar signs have been noted in the stilboestrol-treated cow (Folley & Malpress, 1944; Hammond & Day, 1944).

Bennetts (1949) described the " high tail " of ewes in Australia grazing subterranean clover containing oestrogenic substances.

In general, the effects observed are similar to those obtained by the same treatment in the cow.

Conclusion

The outbreaks of vaginal eversion recorded in several flocks of ewes, and the prevalence of the condition in New Zealand in some years suggest that environmental factors favour the occurrence of the disease. From a study of the circumstances of these outbreaks it is difficult to see what are the particular factors concerned.

The onset of uterine contractions in one ewe has been shown to be the immediate cause of vaginal eversion, although it is equally clear that this was not the only cause. A predisposition to the condition is indicated, as other ewes subjected to similar treatment did not develop it, and there is some evidence that a hormonal imbalance may be involved.

Such a predisposition may well be inherited (vaginal eversion occurs regularly in one closely bred flock), and there is evidence that it is inherited in cattle (Garm, 1949; Koch & Haisch, 1943).

Although further investigation is necessary to confirm this heritability, the practice of culling ewes which have developed vaginal eversion appears a sound one. It should be extended to the lambs from such ewes, which should be marked at birth and not retained for breeding.

Acknowledgments.—I am indebted to Dr. John Hammond, F.R.S., for guidance and to Professor W. I. B. Beveridge for facilities.

Mr. R. C. Campbell kindly did the statistical analyses, and Dr. M. Lobban prepared the sections of the adrenal glands.

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A suggested draft by-law on meat for feeding animals was referred back by Skipton U.D.C. to the Health Committee. Mr. W. M. Crabtree, Vice-Chairman, wanted to know if approval of the by-law meant that no red meat whatever would be available for dog and cat owners. The Sanitary Inspector, Mr. E. Hargreaves, replied that no meat would be sold for animal feeding shops unless first sterilised. Mr. Crabtree, remarking that supervision was essential, feared however that this scheme would only mean driving trade underground. Mr. W. A. Anderson was concerned lest red meat sold for human consumption should be given to animals.—*Meat Trades Journal.*

ENZOOTIC ABORTION IN EWES

Field Trials of Vaccine

I.—BY

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As already reported (McEwen, Stamp & Littlejohn, 1951) a small-scale trial of vaccine against the so-called enzootic abortion of ewes was begun in the autumn of 1949. This was continued and extended during the two following seasons, ending in the spring of 1952.

As far as is known at present, the virus is disseminated only in the spring shortly before and during the lambing season, and the clinical result of infection is seen only at the following lambing season (McEwen, Littlejohn & Foggie, 1951). In the trials reported here it has been the practice, mainly for reasons of convenience, to vaccinate in the autumn shortly before service. Any immunity stimulated by this vaccination would protect against infection in the immediately succeeding spring, but the clinical result of this protection would not be expected until the second spring after vaccination.

It was found, however, that there was a significant reduction in the incidence of abortion* in vaccinated ewes at the first pregnancy after vaccination. This was first noticed in the small-scale trial of vaccine already reported (McEwen, Stamp & Littlejohn, 1951), demonstrated experimentally (McEwen, Littlejohn & Foggie, 1951), by infecting and then vaccinating ewes before service, and confirmed in the first year of the large-scale trial now reported. If abortion is caused by infection acquired at the previous lambing season, the observed reduction in incidence at the first pregnancy after vaccination is attributable to either the elimination or the sequestration of the latent virus as a result of the immunity stimulated before the onset of pregnancy. This might be described as a "curative" effect, to distinguish it from the ordinary prophylactic effect shown at the second pregnancy after vaccination.

The present paper records the results obtained at the second pregnancy after vaccination in the small-scale field trial begun in 1949, and at the first and second pregnancy in a large-scale trial begun in 1950. The results collected at the first pregnancy are recorded separately from those obtained at the second pregnancy, the former being attributed to the "curative" and the latter to the prophylactic effect of vaccination.

Methods

I.—Preparation and Testing of Vaccine

The vaccine used in the field during the autumn of 1949 was prepared from infected yolk sacs. When tested on a small number of pregnant experimental ewes it was found to increase their resistance to the inoculation of the virus. The results of this test have already been recorded (McEwen, Stamp & Littlejohn, 1951).

* For the purposes of this paper, the word "abortion" should be taken as including premature birth and the production of dead or weak full-term lambs or of one normal and one dead or weak lamb.

The vaccine used in the field during the autumn of 1950 was prepared from infected foetal membranes obtained from ewes that had been inoculated subcutaneously with virus during the third month of pregnancy, and slaughtered before the end of pregnancy. The heavily infected areas of the membranes and the infected discharges were frozen at −20° C. and, while frozen, cut into small portions. This material, along with a quantity of buffered saline containing 0·4 per cent. formalin, was disintegrated in an " Atomix " blender, and thereafter sufficient formalinised buffered saline was added to give a 10 per cent. suspension of the foetal membrane material. The suspensions were examined microscopically and only those found to be rich in virus were retained. After being passed through a perforated metal funnel that held back any very coarse material, the suspensions were stored at 4° C. for at least six weeks before being tested for sterility. The sterile suspensions were blended, and after the addition of another 0·1 per cent. formalin, the blended material constituted the vaccine. Sheep and guinea-pigs showed no clinical reaction to the subcutaneous injection of the vaccine.

Table I shows the results of tests in which vaccinated ewes were given a challenge inoculation of virus. It is evident that vaccination has stimulated an increased resistance to infection, the resistance being most clearly shown by those animals that received a " small " infective dose of virus.

Table I

The Immunity of Experimental Ewes injected with the Vaccine that was used in the Field in the Autumn of 1950

		Vaccinated		Control
		Before service (5 ml. subcutaneously on Oct. 14th and 28th)	After service (5 ml. subcutaneously on Dec. 22nd and Jan. 5th)	
Immunity challenged with a " large " infective dose during pregnancy (1 ml. of a 1 : 1,000 dilution of yolk sac subcutaneously on January 21st)	No. of ewes	11	10	9
	No. infected	5	1	8
Immunity challenged with a " small " infective dose during pregnancy (1 ml. of a 1 : 100,000 dilution of yolk sac subcutaneously on January 21st)	No. of ewes	12	12	11
	No. infected	0	1	10

Note.—Ten ewes aborted between February 28th and March 17th. The rest were slaughtered between March 19th and 27th.

The vaccine used in the field during the autumn of 1951 was prepared in the same way as the vaccine used in 1950, but no laboratory tests of its immunising properties were carried out on sheep.

II.—Vaccination in the Field

1950.—The 110 flocks entering the large-scale trial in the autumn of 1950 were (a) 12 of the original 14 flocks and (b) 98 flocks in which the disease had been diagnosed by laboratory examination in the spring of that year. Some of the flocks had experienced the disease in high incidence during several previous seasons, while in others the incidence had been low. Eighty-two of the flocks consisted of half-bred (Border Leicester × Cheviot) ewes and 28 of Cheviot ewes of the " north country " type (as opposed to the " south country " or hill type). With the exception of one flock (in Dumfriesshire) all the flocks were in the south east of Scotland.

(a) In the case of the 12 original flocks, all vaccinated ewes that would still be in the flock in 1952 were revaccinated (see below). Those vaccinated ewes that were to be drafted after the lambing of 1951 were not revaccinated. The rest of the breeding flock, which consisted in most cases only of the gimmers, were vaccinated as described in the next paragraph.

(b) In the case of the 98 " new " flocks and the previously unvaccinated (young) age groups from the 12 "original " flocks, vaccination was carried out by members of the staff of this institute in September and early October, and consisted of the subcutaneous injection of two 5 ml. doses of foetal membrane vaccine with an interval of two to three weeks between the doses. In each flock, the animals vaccinated comprised half of each age group that would still be in the flock at the lambing season of 1952, the remaining half of the age group concerned being left as a control.

1951.—The vaccinated ewes that would still be in the flock in 1953 were revaccinated shortly before service by the subcutaneous injection of a single dose of 5 ml. of foetal membrane vaccine.

III.—Collection of Results

Each shepherd was provided with a notebook in which he was asked to record all cases of abortion, stillbirth, etc., occurring in the flock. Owing to the impossibility of differentiating, in the field, between abortion, premature birth and stillbirth (the service dates are recorded only to the nearest 7 to 10 days) and of distinguishing without laboratory examination between specific and non-specific cases, the criterion by which these trials were judged was the abnormal termination of pregnancy, in whatever circumstances this might occur. The only permissible exception was the obvious accident of parturition such as " hanging " (delivery of the head with retention of the forelimbs) or suffocation on account of the failure of the amnion to rupture after delivery.

Results Obtained at the First Pregnancy After Vaccination

In the small-scale trial started in 1949, in which the vaccine used was made from infected yolk sacs, the figures already published show that 2·4 per cent. of 1,184 vaccinated ewes and 7·8 per cent. of 1,301 controls aborted. In the main trial begun in 1950, in which vaccine prepared from infected ovine foetal membranes was used, 3·7 per cent. of 14,067 vaccinated ewes and 6·2 per cent. of 13,869 control ewes were recorded as clinical cases of abortion (see Table II).

TABLE II

LARGE-SCALE TRIAL OF VACCINE, 1950–52. RESULTS OBTAINED IN 1951, *i.e.*, AT FIRST PREGNANCY AFTER VACCINATION

Age	No. of groups	Vaccinated						Control					
		No. of ewes	Clinical abortion		Correction factor*	Specific abortion		No. of ewes	Clinical abortion		Correction factor*	Specific abortion	
			No.	Per cent.		Estimated No.	Estimated per cent.		No.	Per cent.		Estimated No.	Estimated per cent.
1st crop	109	6,470	207	3·2	22/39	116·8	1·8	6,569	328	5·0	42/60	229·6	3·5
2nd „	100	5,151	224	4·3	39/49	178·3	3·5	4,842	372	7·7	72/86	311·4	6·4
3rd „	55	2,129	74	3·5	23/30	56·7	2·7	2,144	143	6·7	61/74	117·9	5·5
4th „	9	317	11	3·5	—	—	—	314	13	4·1	—	—	—
Total	273	14,067	516	3·7	—	—	—	13,869	856	6·2	—	—	—

* = Number of foetal membranes found to be infected. / Number of foetal membranes examined.

RESULTS OBTAINED AT THE SECOND PREGNANCY AFTER VACCINATION

The results collected in 1951 for the ewes first vaccinated in 1949 and those collected in 1952 for the ewes first vaccinated in 1950 are summarised in Table III. The former (which refer to the animals in the small-scale trial) are shown in italics, and it will be seen that 1·1 per cent. of 835 vaccinated ewes aborted whereas 5·1 per cent. of 1,008 controls aborted. In the main trial, begun in 1950, 1·5 per cent. of 10,870 vaccinated and 5·4 per cent. of 11,308 control ewes aborted at the second pregnancy.

The reduction in the number of ewes under observation in the second year of the main trial is attributable to (a) the usual wastage (5 to 10 per cent.) from disease, accident, infertility, etc., and (b) the elimination from the trials of all the animals in six half-bred and two Cheviot flocks and of individual age groups in several other flocks, on account of change of ownership, failure to keep accurate records, or the addition of newly purchased (and later unidentifiable) ewes to the controls in the autumn of 1951.

It will also be seen from Table III that some ewes were revaccinated in 1951. This was done because they were to be retained in the flock until after the 1953 lambing and it was considered advisable to reinforce their immunity in order to protect against infection during the 1952 lambing season. These revaccinations had no appreciable effect on the incidence of abortion in 1952—a result that was only to be expected if vaccination in 1950 had protected the majority of the ewes during the 1951 lambing season.

RESULTS OBTAINED IN FLOCKS WHERE THE INCIDENCE OF ABORTION WAS HIGH

First Pregnancy.—The previously published figures for the small-scale trial showed that where the incidence of abortion in control ewes was high vaccination was associated with a most significant drop in the incidence of the disease. Thus 2·5 per cent. of 369 vaccinated ewes aborted as compared with 15 per cent. of 379 control ewes (McEwen, Stamp & Littlejohn, 1951).

In the large-scale trial corresponding figures are 7·2 per cent. of 3,289 vaccinated and 15·8 per cent. of 3,254 control ewes (see Table IV).

In the latter trial two flocks had an incidence of abortion in the several control age groups varying from 15·4 to

TABLE III

SMALL- AND LARGE-SCALE TRIALS OF VACCINE. RESULTS OBTAINED IN 1951 AND 1952 AT THE SECOND PREGNANCY AFTER VACCINATION

The figures in italics refer to the results for the small-scale trial collected in 1951

Age	Whether revaccinated	No. of groups	Vaccinated						Control					
			No. of ewes	Clinical abortion		Correction factor*	Specific abortion		No. of ewes	Clinical abortion		Correction factor*	Specific abortion	
				No.	Per cent.		Estimated No.	Estimated per cent.		No.	Per cent.		Estimated No.	Estimated per cent.
2nd crop	*Revaccinated* ...	*9*	*393*	*4*	*1·0*	—	—	—	*483*	*35*	*7·2*	—	—	—
2nd crop	Revaccinated ...	97	5,074	77	1·5	6/20	23·1	0·5	5,310	320	6·0	18/26	221·5	4·2
3rd crop	†	*10*	*442*	*5*	*1·1*	—	—	—	*525*	*16*	*3·0*	—	—	—
3rd crop	Revaccinated ...	61	2,528	44	1·7	5/20	16·5	0·4	2,530	147	5·8	12/17	165·2	3·9
	Not revaccinated	34	1,624	22	1·4				1,747	87	5·0			
4th crop	Revaccinated ...	10	251	5	2·0	—	—	—	237	12	5·1	—	—	—
4th „	Not revaccinated	40	1,231	11	0·9	—	—	—	1,322	35	2·6	—	—	—
5th „	Revaccinated ...	1	37	—	—	—	—	—	38	8	21·1	—	—	—
5th „	Not revaccinated	5	125	3	2·4	—	—	—	124	2	1·6	—	—	—
Total		*19*	*835*	*9*	*1·1*	—	—	—	*1,008*	*51*	*5·1*	—	—	—
Total		248	10,870	162	1·5	—	—	—	11,308	611	5·4	—	—	—

* See footnote to Table II.

† Six of the 10 groups were revaccinated and four were not. As there was no significant difference between them, the results from these two small sub-groups are not recorded separately.

74·5 per cent., the mean incidence being 40·3 per cent. The mean incidence in the vaccinated ewes in these flocks was only 2·8 per cent. (see Table V).

It is evident that the greater the proportion of heavily infected flocks in a trial the better will be the overall results at the first pregnancy after vaccination.

Second Pregnancy.—The results obtained at the second pregnancy after vaccination in flocks where the abortion rate among the controls is high are given in Table VI. In 1952 the abortion rate among the 2,155 vaccinated ewes in these flocks was 2·3 per cent., where as for 2,210 controls it was 13·3 per cent. With the exception of a small group of 38 old ewes none of the control groups showed an abortion rate comparable to those recorded at the first pregnancy (Table V). Nevertheless, the reduction in incidence attributable to vaccination is highly satisfactory.

TABLE IV

LARGE-SCALE TRIAL OF VACCINE 1950–52. RESULTS OBTAINED IN 1951, *i.e.*, AT FIRST PREGNANCY AFTER VACCINATION, IN AGE GROUPS IN WHICH THE INCIDENCE OF CLINICAL ABORTION WAS 10 PER CENT. AND OVER

Age	No. of groups	Vaccinated			Control		
		No. of ewes	Clinical abortion		No. of ewes	Clinical abortion	
			No.	Per cent.		No.	Per cent.
1st crop	19	890	74	8·3	884	159	18·0
2nd „	36	1,822	124	6·8	1,789	247	13·8
3rd „	15	491	29	6·0	500	102	20·4
4th „	2	86	9	10·5	81	6	7·4
Total		3,289	236	7·2	3,254	514	15·8

TABLE V

FLOCKS VACCINATED FOR THE FIRST TIME IN 1950, IN WHICH THE INCIDENCE OF ABORTION WAS EXCEPTIONALLY HIGH IN 1951, *i.e.*, AT THE FIRST PREGNANCY

	Vaccinated			Control		
	No. of ewes	No. of abortions	Per cent.	No. of ewes	No. of abortions	Per cent.
1st crop, Farm A	45	3	6·7	45	27	60·0
1st „ „ B	69	1	1·4	69	25	36·2
2nd „ „ A	51	—	—	52	8	15·4
2nd „ „ B	63	3	4·8	73	25	34·2
3rd „ „ A	36	—	—	41	9	22·0
3rd „ „ B	55	2	3·6	55	41	74·5
Total ...	319	9	2·8	335	135	40·3

EXAMINATION OF FOETAL MEMBRANES

As all abnormal terminations of pregnancy have been recorded in these trials as cases of abortion the results must include a proportion of cases not attributable to infection with the virus of enzootic abortion.

The proportion of specific abortion can be estimated from the results of the examination of foetal membranes from cases of abortion occurring in vaccinated and control ewes respectively. In the main trial 348 such membranes were examined in 1951 and 89 in 1952. For each of the age groups from which an adequate sample of membranes was examined a correction factor—

$$\frac{\text{number of membranes found to be infected}}{\text{number of membranes examined}}$$

—is shown (Tables II and III). From this it will be seen that at the first pregnancy after vaccination (Table II) the proportion of infection in the control ewes was higher than that in the vaccinated ewes in all age groups (except the fourth crop ewes, from which the sample was very small). None of these differences is statistically significant. At the second pregnancy after vaccination however (Table III) the proportion of infected membranes in the control ewes is significantly greater than that in the vaccinated ewes. (In the second crop ewes $\chi_3 = 6{\cdot}972$, $P = < 0{\cdot}01$ and in the third crop ewes $\chi_3 = 7{\cdot}691$, $P = < 0{\cdot}01$.) These findings suggest that at the second pregnancy after vaccination the rate of specific abortion in the vaccinated second and third crop ewes was approximately 0·5 per cent. compared with approximately 4 per cent. in their controls.

The estimated amount of non-specific abortion in both vaccinated and control ewes in the above mentioned age groups varied from 0·8 to 1·5 per cent. in 1951 and from 1·1 to 1·9 per cent. in 1952, indicating that in flocks known to be infected with the virus of enzootic abortion there is also an appreciable amount of non-infectious abortion.

In this respect it may be noted that during 1950, 1951 and 1952, a total of 538 foetal membranes was examined from control ewes and from unvaccinated older ewes in the same

TABLE VI

SMALL- AND LARGE-SCALE TRIALS OF VACCINE. RESULTS OBTAINED AT SECOND PREGNANCY AFTER VACCINATION IN FLOCKS THAT HAD AN INCIDENCE OF ABORTION OF 10 PER CENT. OR MORE

The figures in italics refer to the small-scale trial results collected in 1951. The rest of the table refers to the large-scale trial results collected in 1952

Age	Whether revaccinated	No. of groups	Vaccinated			Control		
			No. of ewes	No. of abortions	Per cent.	No. of ewes	No. of abortions	Per cent.
2nd crop	*Revaccinated*	*1*	*37*	—	—	*87*	*14*	*16·1*
2nd crop	Revaccinated	24	1,274	20	1·6	1,314	169	12·9
3rd „	Revaccinated	12	542	23	4·2	535	80	15·0
3rd „	Not revaccinated	4	197	2	1·0	211	25	11·8
4th „	Revaccinated	2	45	3	6·7	44	5	11·4
4th „	Not revaccinated	1	60	1	1·7	68	8	11·8
5th „	Revaccinated	1	37	—	—	38	8	21·1
Total		*1*	*37*	—	—	*87*	*14*	*16·1*
Total		44	2,155	49	2·3	2,210	295	13·3

flocks. The proportion of membranes found to be infected in each age group is as follows (the number of membranes examined is given in parenthesis): first crop ewes 63 per cent. (100), second crop ewes 81 per cent. (185), third crop ewes 80 per cent. (152), fourth crop ewes 65 per cent. (89) and fifth crop ewes 42 per cent. (12). These figures suggest that the proportion of virus abortion is higher in second and third crop ewes than in gimmers and old ewes—a finding that is compatible with the views already expressed on the epizootiology of the disease (McEwen, Littlejohn & Foggie, 1951).

Summary

Controlled field trials of a vaccine against enzootic abortion conducted in 110 flocks in the south east of Scotland during the period 1949-52 are described. Vaccination shortly before service reduced the incidence of abortion, premature birth and stillbirth at the first pregnancy following immunisation and reduced it still further at the second pregnancy, irrespective of revaccination before this pregnancy.

References

McEwen, A. D., Stamp, J. T., & Littlejohn, Annie I. (1951.) *Vet. Rec.* **63.** 197.

——, Littlejohn, Annie I., & Foggie, A. (1951.) *Ibid.* **63.** 489.

* * * * *

ENZOOTIC ABORTION IN EWES

Field Trials of Vaccine

II.—BY

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Introduction

Following the demonstration of the causal agent of enzootic abortion in ewes by Stamp *et al.* (1950), a survey was conducted in collaboration with the Animal Diseases Research Association, Edinburgh, during the 1950 lambing season among half-bred (Border Leicester × Cheviot) and Cheviot breeding flocks in North Northumberland.

Material was examined from 28 flocks comprising approximately 8,550 ewes. Of this total 186 (*i.e.*, just over 2 per cent.) were said to have aborted and 106 ewes were examined. The virus was demonstrated in approximately 50 per cent. of these cases by examination of either vaginal swab, aborted foetal membrane or both. The infection was diagnosed in 18 of these flocks.

Field Trials of Vaccine

Using foetal membrane vaccine prepared and made available by the Animal Diseases Research Association (preparation described elsewhere in this journal), trials were commenced in autumn, 1950, in nine flocks where the infection had previously been diagnosed. This trial ended in the spring of 1952. Of these flocks seven were of half-bred ewes, one of Cheviot ewes, and the other a mixed flock of half-bred and Cheviot ewes.

Methods

1. *Vaccination.*—Methods and times of vaccination were identical with those described by Littlejohn *et al.* (1952), *i.e.*, half of each age group of ewes that would still be in the flock for the lambing season of 1952 were vaccinated, the other half serving as controls. In 1951 those ewes that would still be in the flock in 1953 were revaccinated.

2. *Collection of Results.*—In both the 1951 and 1952 lambing seasons daily visits were made to the farms and all aborting ewes examined, foetal membranes being recovered when available. This permitted the information regarding abortions, etc., recorded in notebooks issued to the shepherds to be checked.

Results Obtained at the First Pregnancy After Vaccination

In the spring of 1951 3 per cent. of 1,262 vaccinated ewes and 5 per cent. of 1,233 control ewes were recorded as clinical cases of abortion (see Table I). $\chi^2 = 6{\cdot}135$, $P = 0{\cdot}0134$. These figures signify a lowering of the abortion rate attributable to vaccination even at the first pregnancy after vaccination.

Results Obtained at the Second Pregnancy After Vaccination

In the spring of 1952 1·6 per cent. of 944 vaccinated ewes and 4·5 per cent. of 991 control ewes were recorded as clinical cases of abortion (see Table II, page 868). $\chi^2 = 14{\cdot}02$, $P = <0{\cdot}001$. These figures signify a very substantial lowering of the abortion rate, a result attributable to vaccination.

The lowering in the total numbers of ewes in the second season of observations is explained by Littlejohn *et al.* (1952), and the same reasons are applicable in this trial. One flock of half-bred ewes is eliminated due to change of ownership and one age group of half-bred ewes in another flock is eliminated due to inadequacy of the identifying mark applied to the vaccinated ewes with subsequent discrepancy in the numbers of vaccinated and control ewes.

Table I

Field Trials of Vaccine, 1950–52. Results obtained in 1951, *i.e.*, at First Pregnancy after Vaccination

Age	No. of groups	Vaccinated						Control					
		No. of ewes	Clinical abortion		Correction factor*	Specific abortion		No. of ewes	Clinical abortion		Correction factor*	Specific abortion	
			No.	Per cent.		Estimated No.	Estimated per cent.		No.	Per cent.		Estimated No.	Estimated per cent.
1st crop	9	554	14	2·5	4/11	5·1	0·9	548	12	2·2	7/9	9·3	1·7
2nd ,,	9	555	23	4·1	10/14	16·4	2·9	540	46	8·5	27/30	41·4	7·6
3rd ,,	1	40	—	—	—	—	—	40	1	2·5	1/1	—	—
4th ,,	1	113	1	0·9	1/1	—	—	105	2	1·9	1/1	—	—
Total	20	1,262	38	3·0	—	—	—	1,233	61	5·0	—	—	—

* = Number of foetal membranes found to be infected. / Number of foetal membranes examined.

TABLE II
FIELD TRIALS OF VACCINE. RESULTS OBTAINED IN 1952, *i.e.*, AT SECOND PREGNANCY AFTER VACCINATION

Age	Whether revaccinated	No. of groups	Vaccinated						Control					
			No. of ewes	Clinical abortion No.	Clinical abortion Per cent.	Correction factor*	Specific abortion Estimated No.	Specific abortion Estimated per cent.	No. of ewes	Clinical abortion No.	Clinical abortion Per cent.	Correction factor*	Specific abortion Estimated No.	Specific abortion Estimated per cent.
2nd crop	Revaccinated ...	8	478	10	2·1	3/6	5·0	1·0	476	29	6·1	14/16	25·4	5·3
3rd "	" ...	1	56	—	—	—	—	—	69	4	5·8	4/4 } 10/11	4·0 } 14·5	5·8 } 3·5
	Not revaccinated	6	325	5	1·5	2/4	2·5	0·8	347	12	3·3	6/7	10·3	2·8
4th "	" "	1	34	—	—	—	—	—	38	—	—	—	—	—
5th "	" "	1	51	—	—	—	—	—	61	—	—	—	—	—
Total		17	944	15	1·6				991	45	4·5			

* See footnote to Table I.

As already stated, ewes to be retained until after the 1953 lambing season were revaccinated once in the autumn of 1951, this revaccination serving to maintain immunity against infection in the 1952 lambing season.

Results Obtained in Flocks where the Incidence of Abortion was over 10 per cent.

In four flocks the incidence of abortion in the control groups of ewes carrying their second crop of lambs was over 10 per cent., and in these flocks the results of vaccination were particularly satisfactory.

Thus in 1951 5·2 per cent. of 230 vaccinated second crop ewes (first pregnancy after vaccination) aborted compared with 14·6 per cent. of 219 control ewes. In 1952 in the same flocks 2·4 per cent. of 206 vaccinated second crop ewes (second pregnancy after vaccination) aborted compared with 10·7 per cent. of 216 control ewes.

Examination of Foetal Membranes

Despite daily visits to the flocks in this trial it was impossible to obtain foetal membranes from all cases of aborting ewes. The following membranes were obtained—in 1951 67 membranes were recovered from the total of 99 aborting ewes and in 1952 37 membranes were recovered from the total of 60 aborting ewes. These membranes were examined for the macroscopic lesions of the infective disease and also microscopically for the elementary bodies of the virus.

By application of the correction factor referred to by Littlejohn *et al.* (1952), the proportion of specific abortion is estimated in vaccinated and control ewes (see Tables I and II).

In the first pregnancy after vaccination the only reduction in infection as determined by the examination of foetal membranes occurs in gimmers (Table I), but this is of no statistical significance. In the second pregnancy after vaccination reduction in infection occurs in both second and third crop vaccinated ewes (Table II), but statistically this reduction is just outside the accepted limits of significance (in second crop ewes $\chi^2 = 3{\cdot}494$, $P = 0{\cdot}06$, and in third crop ewes $\chi^2 = 3{\cdot}068$, $P = 0{\cdot}08$).

Conclusion

The results of vaccination in the Northumberland flocks support the findings of Littlejohn *et al.* (1952) and show that vaccination reduces the incidence of enzootic abortion in the first pregnancy following vaccination and that the effect is even more pronounced in the second pregnancy after vaccination. This trial shows that vaccination is particularly effective in ewes carrying their second crop of lambs.

Summary

Controlled field trials of a vaccine against enzootic abortion in nine flocks in Northumberland during 1950-52 are described.

Vaccination just before service reduced the incidence of abortion in the first pregnancy following vaccination and still further in the second pregnancy.

Acknowledgments.—The writer records grateful acknowledgments to W. Lyle Stewart, M.R.C.V.S., V.I.O. at this centre, for his continued interest and advice in this work ; to Dr. A. D. McEwen and the staff of the Animal Diseases Research Association for continued advice and co-operation ; to the staffs of the Wooler District Office of the Northumberland A.E.C. and of this centre for much valuable assistance in the carrying out of the field work ; and to the Director of the Veterinary Laboratory, Weybridge, for permission to publish this work.

References

Littlejohn, Annie I., McEwen, A. D., & Foggie, A. (1952.) *Vet. Rec.* This issue.

Stamp, J. T., McEwen, A. D., Watt, J. A. A., & Nisbet, D. I. (1950.) *Ibid.* **62.** 251.

Weekly Wisdom

The beauty of a work of art depends on its form, its greatness on its content. A miniature of jewelry is no less beautiful than a cathedral, but a miniature is not a great work of art, only a perfect or an exquisite work of art.—The Times Music Critic.

* * * * *

VACCINATION OF CALVES AGAINST ABORTION

At a recent meeting of the Devon Diseases of Animal Committee Mr. G. Atkinson, South-west Area Superintending Veterinary Officer, requested members to emphasise to farmers the great need to vaccinate calves against contagious abortion. He said Devon was falling behind other counties in the vaccinations, and the result might be a big outbreak of the disease.

Asked if the vaccinations affected fertility in calves, Mr. Atkinson said the vaccine had been in use for ten years, and where infertility had occurred after vaccination it was only coincidental.

THE VETERINARY RECORD

December 27, 1952

SLAUGHTERING POLICY

INTEREST in our present slaughtering and meat rationing policy has become more apparent within recent weeks. The Minister of Food has outlined the general principles on which the siting of our abattoirs should be planned. The official view, with which we concur, is that whilst it is undesirable to revert to pre-war conditions in which thousands of premises—the majority small and ill-equipped—were in use, a few large factory type abattoirs are not suited to our peculiar needs and economy. It is, therefore, proposed to continue the policy of moderate concentration until some 300 or 400 abattoirs are available to serve the national needs.

The Government has made it plain that the rationing system should be terminated as soon as practicable but it proposes to continue to exercise some control over slaughterhouse policy. The Minister of Food has indicated that there should be some central regulation to ensure that buildings in which slaughtering is carried on are so sited and equipped as to meet all the requirements of hygiene, meat inspection and humane slaughtering with reasonable economy. To this end, it is proposed to discuss this development with interested parties, amongst which, we are pleased to note, are included professional bodies concerned with these matters.

Government control of fat stock and slaughtering was undoubtedly desirable to meet the exigencies of war and its aftermath, and it is difficult to conceive how otherwise the nation could have been adequately fed and nourished. It is easy to be critical, but credit must not be withheld where it is merited. It must be admitted freely that the Ministry of Food assumed the responsibility for our meat supplies under trying circumstances, and that difficult times attended its venture into a sphere of activity which was novel to the Civil Service. It had to make use of the manpower which was available. It would be foolish to deny that mistakes were made and that some—having been made—were perpetuated. Within its limitations the Ministry has done a good job often under most difficult conditions. It is, however, generally conceded by all who are competent to give an unbiased opinion, that it is no longer expedient to continue the present arrangement indefinitely. Divided responsibility is the cause of many difficulties in the abattoir. There are too many sectional interests.

Proposals for a Fat Stock Marketing Scheme have been mooted by various bodies and more recently the National Farmers' Unions have drawn up such a scheme. Some such reorganisation of our slaughtering policy holds out great potentialities for the improvement of the quality of our home meat supplies ; also for the hygienic and economical disposal of meat and the very many by-products of the abattoir. The claims of the consuming areas as opposed to the producing areas as sites for our abattoirs need to be considered carefully. It must be obvious to anybody with a knowledge of our present system, that anything which makes it possible for animals to be delivered direct from the farm to the abattoir must prove advantageous both to the public and to animal welfare.

The Unions' proposals have not been passed to the British Veterinary Association for consideration and comment. We have not yet examined the details of this scheme but it must be remembered that it is a producers' not a consumers' scheme, and will need to be scrutinised carefully before unqualified approval can be given.

The proposal to slaughter in the producing areas, rather than in the towns, may tend to a reversion to some of the undesirable features inherent in our pre-war system. Centralised slaughtering should be pursued, not abandoned or watered down ; for only by the use of units of adequate size can our slaughtering operations be conducted in a satisfactory manner. There is something to be said, however, in favour of well-planned and properly equipped small abattoirs, sited in our hill sheep-producing areas. Such abattoirs might serve other purposes in addition to slaughtering. They might well promote the development of small rural industries which could utilise the by-products of slaughter for the production of goods which have become less attractive to the larger manufacturer. The extension of electric supplies to these remoter areas should encourage such projects and render practicable the rehabilitation of some, at least, of our neglected grazing areas.

PRODUCTIVITY OF EUROPEAN-TYPE CATTLE IN THE TROPICS

Twin Calf Experiment

The Colonial Office Information Department states that a preliminary report on the results of the twin calf experiment which was carried out by the Fiji and New Zealand Departments of Agriculture at Sigatoka, Fiji and Ruakura, New Zealand, has been issued by the Public Relations Office, Fiji. The purpose of the experiment, which was assisted financially by the South Pacific Commission, was to obtain basic information on the effect of a tropical climate on the productivity of European-type cattle. One series of twins was kept at the animal research station of the New Zealand Department of Agriculture and the other at the Sigatoka agricultural station. Both series were fed identical food and the management at both stations was standardised. Thus the only difference in their up-bringing was that of the climate. The basic ration was New Zealand lucerne hay, supplemented by a coconut meal concentrate produced in Fiji.

The Fiji heifers were brought from New Zealand at the age of about six months and they calved when two years old. At two years of age all the New Zealand animals were heavier than those in Fiji. The smallest difference in weight was 38 lb. and the maximum 183 lb., with a mean of 90·6 lb. Both milk production and the percentage of butterfat were lower in Fiji than in New Zealand. Many tests were made on blood constituents, etc., but these and other tests revealed no marked physiological differences except that the Fiji twins had a much higher water intake. The general conclusion is that there appears to be some form of physiological limit to the growth and production of European-type dairy stock in a tropical environment, particularly during the hot wet months, but that there is considerable variation between individual animals in their ability to acclimatise.

Other work at Sigatoka has shown that there are strains of European breeds of livestock with a high heat tolerance and the practical answer to herd improvement may lie in the importation of sires, not only of good productive capacity based on pedigree but also with a high measure of heat tolerance.

The twin calf experiment focuses attention on the importance of breeding livestock which are adaptable to a tropical environment: a high plane of nutrition is not enough. Apart from heat tolerant strains of European breeds it would appear that attention must be given to animals with Zebu blood such as the Red Sindhi Jersey Cross dairy stock and the Santa Gertrudis beef breed evolved on the King Ranch Texas by the crossing of European Shorthorn cattle and the Nellore strain of Zebu.

* * * * *

Horse-drawn landaus of the Victorian era have been licensed by Edinburgh magistrates to ply for hire as taxicabs from April to October next.

CLINICAL COMMUNICATION

AN OUTBREAK OF *LEPTOSPIRA ICTEROHAEMORRHAGIAE* INFECTION IN CALVES

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The occurrence of *Leptospira icterohaemorrhagiae* infection in a young calf has been reported in this country in recent years by Field (1949) and Field and Sellers (1950). These authors record the isolation and identification of the leptospira species concerned, and describe the experimental infection of calves with the strain.

During November, 1951, we encountered an outbreak of leptospirosis in calves and had the opportunity of studying the clinical picture and general course of the disease, and we record here the details of our observations.

HISTORY

The outbreak occurred amongst calves up to two months old, in a self-contained herd of attested Friesian cattle kept under very good conditions of feeding and management. Calves born on the farm were suckled on their dams for three days and then transferred to a large semi-open pen where they received whole milk from the bucket. At the age of about three weeks they were moved to a similar adjacent pen and fed on calf gruel, which was prepared from a proprietary brand of calf meal, calf nuts and hay. Pen I contained 11 calves varying in age from three days to about three weeks, whilst Pen II housed 14 calves between three weeks and three months old, the two pens being separated by a solid partition, 3 feet 6 inches high.

With the exception of ringworm, the calves were notably free from the common calf diseases.

Ten days before our first visit to the farm the owner noticed that one of the calves in Pen II (Calf L—see Table I) was dull and in very low condition. The calf was transferred to Pen I along with the smaller and younger animals, and bucket fed on whole milk. During the days following, Calf L slowly improved, but nine of the remaining 13 calves in Pen II had very poor appetites, became thin and showed general dullness; the sucking of one calf's navel by another calf was evident.

CLINICAL DATA

On November 12th, 1951, one of us (E. J. J.) was consulted about the sudden death of a calf and the poor condition of a number of others.

An examination of the calves revealed that those in Pen I, including Calf L, were clinically normal animals. Pen II, however, contained a dead calf (Calf A), four rather thin but otherwise normal calves (Calves H, I, M and N), and eight calves showing the following symptoms: emaciation, staring coat, tucked up abdomen, listlessness, jaundice to a varying degree; temperature was normal or subnormal. There was no evidence of scouring and no haemoglobinuria. Emaciation was a most pronounced feature and the calves resembled animals that had been deprived of food for some days. Icterus was most readily discernible in the sclera, gums, under the tongue and around the coronets and horn buds.

As the main difference in management between the two pens of calves was the feeding of calf gruel to the affected group, the meal used for its preparation was suspected. Interim treatment consisted of substituting whole milk for the calf gruel, and giving supplements of cod-liver oil and yeast, and 5 grammes of sulphamezathine orally to each of the two calves in the worst condition (B and C).

On the following day Calf B was found dead. Calves C and F were in a state of semi-collapse for which they were treated with intravenous injections of 400 c.c. citrated whole blood from cows Y and X respectively; rapid responses were noted.

From the gross *post-mortem* lesions of Calves A and B the possibility of leptospirosis was considered. When it was suggested that a rat-borne infection might be responsible for the disease in the calves, the owner volunteered the information that feeding from the bin of calf meal in use at the time had been commenced approximately 10 days before Calf L was first noticed to be ill and that it was known to have been badly contaminated by rats. The diagnosis of leptospirosis was put on a firmer basis, however, when leptospira were readily demonstrated under dark-ground illumination in the blood of two out of 11 affected calves (G and J).

At this stage the condition of all the calves showed improvement and, in view of this, it was decided not to treat them with specific leptospira serum. By November 22nd, 1951, 10 days after the first death, jaundice had disappeared completely and the calves were feeding well. Nevertheless, the calves had suffered a severe setback in condition and growth rate. One of the recovering calves is illustrated in Fig 1. (overleaf) along with a slightly younger, clinically normal calf from Pen I.

Since the outbreak there have been cases of scours among the previously affected animals, and mild cases of calf diphtheria have occurred in all calves on the farm.

Calf F collapsed and died on December 1st, 1951, and *post-mortem* examination revealed the general lesions of cardiac failure and an incomplete interventricular septum in the heart. In addition to these findings, a moderate number of small grey " spots " was visible on the surface of the cortex of both kidneys after the capsule had been stripped, and, also, on cross section, in the depths of the cortex. In histological sections, stained with haematoxylin and eosin, these " spots " consisted of focal infiltrations of the interstitial tissue with small mononuclear cells—chiefly of the lymphocyte type—and a few histiocytes. These foci of interstitial nephritis were irregularly distributed through the cortex, some beneath the capsule and others near the boundary zone, but none was found in the medulla. Attempts to isolate leptospira from the liver and kidney of this calf by guinea-pig inoculation, however, were unsuccessful.

POST-MORTEM LESIONS

Autopsy findings were similar in both calves that died of leptospira infection (A and B). The carcases were in very poor condition and the hair around the umbilicus and sheath was wet and matted. All tissues were jaundiced; the yellow discoloration was most obvious in the tendons, aorta and connective tissues, and the musculature was a salmon-pink colour. Scattered small groups of petechial haemorrhages and a few ecchymoses were found in the body musculature and fascia; in one calf they were confined to the inguinal region and the fascia round the stifle joints, whilst in the second they were present in the muscles of

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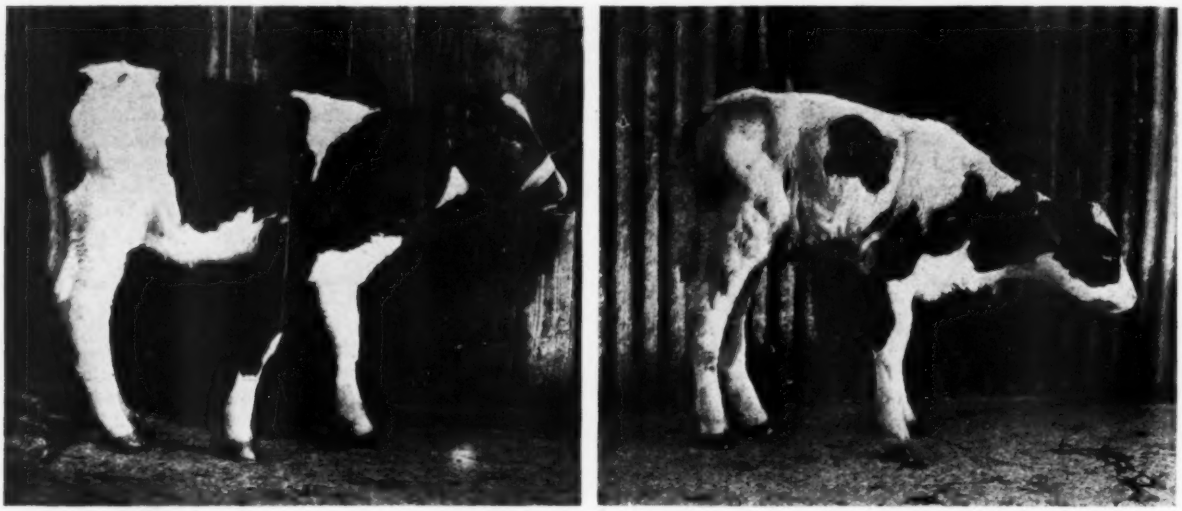

Fig. 1.—Left—clinically normal calf from Pen 1. Born 20.10.51. Right—Calf C at commencement of recovery. Born 11.10.51. Note emaciated condition, dejected appearance, staring coat and tucked up abdomen.

the thighs and under the left scapula. In the first calf only, petechial haemorrhages were seen on the epicardium. A marked yellow gelatinous oedema of the mediastinum just dorsal to the sternum was present in both calves. No macroscopic lesions were seen in the lungs, livers, kidneys or spleens; no haemoglobinuria was detected.

Cultural examination on blood agar plates of the heart blood, liver and spleen of both calves yielded no organisms of significance after seven days' aerobic incubation.

Haematoxylin and eosin-stained sections of the kidney of Calf B revealed a mild diffuse infiltration of the interstitial tissue of the cortex with small mononuclear cells. In liver sections, the hepatic cords were distorted, though there was no liver cell necrosis; slight mononuclear infiltration of the portal tracts was observed. Liver and kidney sections from Calf A showed similar though less pronounced changes. No leptospira could be demonstrated in Levaditi-stained sections from either calf.

Pathogenicity and Protection Experiments in Guinea-pigs

Guinea-pigs were inoculated intraperitoneally with 3 c.c. of blood (positive for leptospira by dark-ground illumination) taken from Calf J at about the 10th day of illness, and with *post-mortem* material (½ c.c. of a suspension of liver and kidney in sterile distilled water) from Calf B. Young guinea-pigs of about 300 grammes weight were used throughout for inoculations. These guinea-pigs showed temperature rises between the 7th and 12th days post-inoculation (maximum 105·6° F.), followed by weakness and jaundice. They were killed on the 14th day in a moribund condition. *Post-mortem* examinations showed generalised jaundice, petechiae and congestion of the subcutaneous tissues, petechiae in the kidneys, typical " butterfly " haemorrhages on the lungs and pleura, congestion and oedema of the inguinal fat, perirenal connective tissue and omentum; small necrotic foci were present in the liver. Cultures prepared from the heart blood, liver and kidney on blood agar plates remained sterile for seven days on aerobic incubation. Leptospira were found in large numbers in liver and kidney suspensions and were isolated in culture in Fletcher's medium. Passage of the leptospira from cultures or liver suspensions through young guinea-pigs produced death in 11 days and subsequently death regularly at the fourth or fifth day. Lesions in these guinea-pigs were similar to those described above except that in cases of early death no focal liver lesions were discernible macroscopically. Autopsy lesions in these guinea-pigs were typical of those produced by *L. icterohaemorrhagiae* infection.

Protection experiments using commercial hyperimmune *L. icterohaemorrhagiae* serum (Burroughs, Wellcome & Co.) were done in guinea-pigs. Three young guinea-pigs were given 1·5 c.c. each of *L. icterohaemorrhagiae* serum subcutaneously, and one hour later these three guinea-pigs along with a further three control guinea-pigs were injected with 0·25 c.c. each of a liver and kidney suspension from an infected guinea-pig. All three control animals died on the fourth day with characteristic lesions on *post-mortem* examination, whilst those that had received protective serum showed no symptoms and survived.

Agglutination Tests

The calf sera were tested in final dilutions of 1:10 to 1:3,000 against formalinised cultures of *L. icterohaemorrhagiae*.* The tubes were examined for agglutination by dark-ground microscopy after 18 hours at 4° C. The results recorded in Table I show the variation in titres of the calves in Pen II, Calf L which had been transferred to Pen I, three calves selected at random from Pen I in contact with Calf L, and the two cows used for the blood transfusions.

Two of those sera which showed a high titre to *L. icterohaemorrhagiae* were tested against *L. canicola*, and only slight cross-agglutination was observed—see Table II.

L. icterohaemorrhagiae and *L. canicola* are the only two pathogenic leptospira species that have been isolated from animals in this country up to the present time. (Dr. J. C. Broom—personal communication).

* *L. icterohaemorrhagiae* strain kindly supplied by Dr. J. C. Broom.

TABLE I
VARIATION IN AGGLUTINATION TITRES OF CALVES IN PENS I AND II

	Calf	Sex	Date of birth	Titres 14.11.51	26.11.51	14.1.52	27.3.52	
Pen II	A	M.	5.10.51	Died on 12.11.51. Leptospirosis				
	B	M.	11.10.51	„ 13.11.51. „				
	C	M.	11.10.51	—	1 : 1,000	1 : 300	1 : 300	
	D	M.	4.10.51	1 : 10	1 : 300	1 : 1,000	1 : 100	
	E	M.	11.10.51	0	1 : 300	1 : 300	1 : 30	
	F	M.	11.10.51	0	1 : 300	Died 1.12.51		
	G	M.	21.9.51	1 : 10	1 : 1,000	1 : 3,000	1 : 300	
	H	M.	3.10.51	0	1 : 300	1 : 1,000	1 : 300	
	I	M.	20.10.51	0	0	1 : 1,000	1 : 30	
	J	F.	4.10.51	0	1 : 1,000	>1 : 3,000	1 : 300	
	K	F.	8.10.51	1 : 30	>1 : 3,000	—	1 : 100	
	M	F.	9.10.51	0	1 : 300*	—	1 : 30	
	N	F.	25.9.51	1 : 10	1 : 1,000	1 : 30	1 : 30	
Pen I	L	F.	9.10.51	1 : 300	1 : 30	1 : 300	1 : 10	
	O	F.	20.11.51	0	1 : 30*	0	0	Random selected calf
	P	M.	19.10.51	0	0	1 : 300	1 : 30	„ „
	Q	F.	20.10.51	0	>1 : 3,000*	1 : 1,000	1 : 10	„ „
Cows	X	F.	Adult	—	0	—	—	Cows used for blood transfusions
	Y	F.	„	—	1/10	—	—	

— = Not sampled. 0 = No reaction at 1 : 10. * Sampled 10.12.51.

TABLE II
CROSS AGGLUTINATION TESTS

Calf serum	Antigen	Serum dilutions 1 : 10	1 : 30	1 : 100	1 : 200	1 : 400	1 : 800	1 : 1,600	1 : 3,200	1 : 6,400	1 : 12,800	Negative control serum
Calf G, 14.1.52	*L. icterohaemorrhagiae*	+	+	+	+	+	+	+	Tr.	—	—	—
	L. canicola	+	+	—	—	—	—	—	—	—	—	—
Calf J. 14.1.52	*L. icterohaemorrhagiae*	+	+	+	+	+	+	+	+	Tr.	—	
	L. canicola	+	—	—	—	—	—	—	—	—	—	

+ = Complete agglutination. Tr. = Trace agglutination. — = No agglutination.

DISCUSSION

The following facts provide ample evidence that the leptospira isolated was *L. icterohaemorrhagiae*:—

(i) The typical reaction produced in guinea-pigs.

(ii) The protection afforded to guinea-pigs with *L. icterohaemorrhagiae* hyperimmune serum against a lethal dose of infective material.

(iii) The development in affected calves of materially higher agglutinin titres to *L. icterohaemorrhagiae* than to *L. canicola*.

The demonstration of rising titres in the calf sera at the time of illness or shortly after, followed subsequently by a falling titre, and the demonstration of a leptospiraemia in two sick calves, associates this leptospira species beyond reasonable doubt with the clinical syndrome observed in the calves.

The rat is the usual reservoir host for *L. icterohaemorrhagiae*, but we were unable to isolate leptospira from the one rat trapped on the premises and its blood serum showed no agglutination reaction. The probability that the infection was derived from rat contamination, however, cannot be excluded on this evidence, but in the circumstances it was not possible to examine more rats. It is of interest to note that a blood sample from the farm cat, which was an active rat-catcher, did not react with *L. icterohaemorrhagiae*. It is tempting to incriminate the rat-contaminated calf meal as the source of infection because it was fed only to the group of calves which later developed clinical symptoms. Nevertheless, the infection might equally well have come from direct contamination, by rat excreta, of the straw bedding or food in the calf pen.

In this outbreak of leptospirosis the calves showed a high incidence of infection with *L. icterohaemorrhagiae* as indicated by the development of serum titres by every surviving calf in Pen II. Moreover, the transference of an infected calf (Calf L) by the owner from Pen II to a hitherto unaffected group of calves (Pen I) was followed by the development of significant titres in at least two of the calves—see Table I. On the other hand, the organism was of only moderate pathogenicity for calves, judged by the relatively low mortality rate and satisfactory spontaneous recovery of the majority of the calves. Only two out of the 13 calves in Pen II died; seven of the remainder showed transient jaundice, inappetence and emaciation. None of the calves in Pen I showed symptoms, though there were at least two sub-clinical infections as noted above.

Blood samples for *L. icterohaemorrhagiae* agglutination tests were collected from the calves both during the outbreak and after recovery. When first tested only one animal (Calf L) showed a titre which was regarded as significant, and this was the one that had been ill 10 days

previously. The samples were taken at too widely spaced and infrequent intervals to indicate when the maximum response for each calf occurred, but high titres were recorded both 12 and 61 days after the appearance of marked symptoms, and appreciable ones were still present after 134 days. In only three instances were titres greater than 1:3,000 noted and in one of these the end point was 1:6,400 (trace agglutination, Calf J. January 14th, 1952). These titres are of the same order of magnitude as Field and Sellers (1950) found in calves experimentally infected with *L. icterohaemorrhagiae*. It is evident from these observations that animals in the early stages of an outbreak may show a low agglutination titre which is difficult to interpret, and it may be necessary to wait for a rise in titre before reaching a definite diagnosis by this test.

No febrile reaction was recorded in any of the affected calves during the course of the disease, even when a leptospiraemia was detected, but the initial stages of the disease were not observed by us and a pyrexia may have occurred previously. The appearance of jaundice did not carry with it a grave prognosis, *e.g.*, nine calves in Pen II exhibited jaundice and all except two recovered. This is in marked contrast to *L. icterohaemorrhagiae* infection in dogs, where, irrespective of treatment, the occurrence of jaundice is usually followed by death.

The pathogenicity of *L. icterohaemorrhagiae* for man must be borne in mind when leptospirosis is diagnosed or suspected in calves. The stockman on the farm in question took reasonable precautions when tending the sick calves and a blood sample taken from him about four months after the outbreak showed no detectable agglutinins to the *L. icterohaemorrhagiae* suspension.

Summary

An outbreak of disease in calves was shown to be caused by *L. icterohaemorrhagiae*. In this outbreak, the mortality rate was low, although the majority of calves on the farm eventually became infected.

Acknowledgments.—We wish to thank the owner and stockman of the farm concerned for their willing co-operation in all respects; Professor C. Formston and Mr. E. J. Roberts of the Surgery Department, Royal Veterinary College, for housing one of the calves during a period of observation and for the photographs in Fig. I; and Dr. Blanche Spence for collecting the blood sample from the stockman.

We are indebted to Professor T. J. Bosworth and, Mr. J. W. H. Holmes for their helpful criticism in recording these observations.

References

Field, H. I. (1949.) *Proc. roy. Soc. Med.* **42.** 719.
——— & Sellers, K. C. (1950.) *Vet. Rec.* **62.** 311.

THE WORLD FOOD SITUATION

On December 17th the Food and Agriculture Organisation published its second survey of the world food situation. It states that since the first survey appeared, in 1946, there has been a gradual though uneven recovery of supplies from their lowest point. In highly developed western Europe recovery has been rapid, in contrast with the regions where the situation was worst and where the population has increased most, such as South America and south-east Asia.

For the future the organisation defines a series of nutritional objectives which, it says, should be reached in 1960, but it adds a warning that the greatest difficulties are bound to be encountered in the areas where the food supply is now inadequate and population increases are greatest. Success can only come if another world war is avoided, and if technical, educational, and administrative development is intensified along the present lines.

ABSTRACT

Survival on Pasture of Larvae of *D. viviparus**

In the first of these two papers the author reports the results of his study of the survival of the non-parasitic larvae of *Dictyocaulus viviparus* on naturally infected pastures. The pastures are described. Examination showed them to be infested with the non-parasitic larvae of *Haemonchus contortus, Trichuris ovis* and *D. viviparus*. Cattle grazed on them had developed parasitic bronchitis, yearlings showing symptoms first, heifers next and cows last. A table gives the results of faecal examinations of the yearlings and heifers and of autopsies of the four yearlings that died. All the yearlings and heifers became infected with *D. viviparus, H. contortus* and *T. ovis*.

Two months after the pastures had been vacated by cattle infected with *D. viviparus*, four Shorthorn steers were grazed on the pastures from October 25th, 1950, until February 1st, 1951. Faecal examinations of these steers by a Baermann technique and intradermal tests by a technique in process of refinement by the author, satisfied him that they were free from *D. viviparus* and *H. contortus*. Weekly faecal examinations done during the period of grazing on the pastures satisfied the author that the cattle were free from *D. viviparus* and *H. contortus*, but eggs of *T. ovis* were found after 40 days of grazing. The relevant meteorological data are given. One steer died on January 4th, 1951, but *D. viviparus* was not found in it. The author concludes that the cattle were not infected by grazing on the pastures. He refers to the work of Porter (1942. *Proc. Helm. Soc.*, Wash., **9**, 60), who found that closing pastures for five months, or for 43 or 48 days, sterilised them of the infective larvae of *D. viviparus*.

In the second paper the author records his study of the survival of the first and infective larvae of *D. viviparus* and *D. filaria* on red clover, sheep's parsley, spinach, lucerne, timothy, and marrow grown in square boxes on sterilised soil. The larvae were placed in the centre of these boxes of plants after the latter had been either watered or wetted by rain. The plants were examined later by clipping them close to the soil with scissors and then recovering larvae by first soaking and squeezing dry the clippings and then recovering any larvae left on them in a Baermann apparatus. The washings thus obtained were sedimented in jars for 12 hours and the sediment was examined. Soil-scrapings were also examined by the Baermann technique. Losses of larvae inevitably associated with the technique were estimated and allowed for. The relevant data regarding the temperature, rainfall and hours of sunshine are given in a table.

The results of the examinations of the various plants used are shown in three tables. Three experiments were made. For the first two the first-stage larvae of *D. viviparus* and *D. filaria* were used and for the third the infective larvae of these two species. The results confirm those obtained by Porter *(loc. cit.)*.

In the first two experiments the percentage of first-stage larvae recovered fell below 1 after two weeks. For experiment 1 these first-stage larvae were in faeces which were put on the plants, so that bacterial action affected the larvae. For the second experiment the first-stage larvae were recovered from faeces before they were put on the plants and the percentage of first larvae recovered was

* **Observations on the Survival on Pasture of Pre-parasitic Stages of *D. viviparus* in S. England.** Soliman, K. N. (1952.) *Brit. Vet. J.* **108.** 167–172; 204–213.

greater than that of larvae exposed, in experiment 1, to faecal bacterial action. For experiment 3 infective larvae were used and these were put directly on to the plants. None of the infective larvae of *D. filaria* was recovered after 35 days and none of those of *D. viviparus* after 28 days. In all three experiments the percentage of larvae of *D. filaria* recovered was "somewhat greater" than that of larvae of *D. viviparus*. The opinion is expressed that this may be explained by the larger size and greater vigour of the larvae of *D. filaria*. More larvae were recovered from red clover, lucerne and marrow and larvae survived longer on these plants, which, the author suggests, give better shelter. He also suggests that the larvae of *D. filaria* are better climbers and therefore survive longer. The figures of larvae recovered represent only a minimal estimation of the survival rate because of the losses of larvae inevitably associated with the techniques used.

G. L.

ROYAL COLLEGE OF VETERINARY SURGEONS

DECEMBER, 1952, MEMBERSHIP EXAMINATIONS

List of Successful Candidates

(*Continued from page* 846)

London

First Examination

Biology only

Bousfield, W. E. D.
Byrne, G. A.
Cullinane, J. A.
Howse, J. N.
May, J. N. T.
Owen, D. P.
Stocks, B. M.
Taner, J. A.

Glasgow

Third Examination

Carrigan, T. D.
Gracie, D. K.
Haresnape, I. C.
Harrison, T. C.
Hutchison, James
Torrance, D. S.

Fourth Examination

Bickerton, D. T.
Bradley, J. A. P.
Brown, P. R.
Calder, H. A.
Gilmour, M. J.
Jawara, S. A.
Macready, P. H.
Russell, D. A.
Stewart, G. H.
Thom, Alasdair

Fifth Examination

Anderson, A. C.
Armour, James
Cunningham, M. P.
Dick, I. B.
Laing, D. F.
McKean, Hugh
McLachlan Iain
Macmillan, I. A.
Morgan, D. I.
Skinner, D. I.
Steel, E. R.
Taylor, A. McKim
Townley, Miss D. M.
Watson, J. G.
Watt, W. R.
Young, D. K. M.

(*To be concluded*)

QUESTIONS IN PARLIAMENT

Horses (Transit and Slaughter)

Mr. Hastings (December 18th) asked the Prime Minister whether he is aware that, despite the redistribution of Ministerial functions relating to cruelty connected with horse slaughter, there is continued evidence of the absence of effective or co-ordinated treatment of the problem; whether his attention has been called, in particular, to the arrival at Birkenhead on November 19th of some horses consigned to Bristol which, on veterinary examination, were found to be suffering from old standing and painful lesions rendering them unfit for movement; whether he is aware that the terms of reference of the committee set up by the Minister of Food and the Secretary of State for Scotland prevent any consideration of questions relating to cruelty in the transport of horses to slaughterhouses; and whether he will, therefore, further review the co-ordination and application of Ministerial functions in this field.

The Prime Minister: The terms of reference of the committee set up by the Minister of Food and the Secretary of State for Scotland refer to cruelty in the slaughter of horses. Cruelty in transit is dealt with by the Minister of Agriculture, and effective Orders exist for preventing unnecessary suffering by horses in transit. The Government have, of course, no control over conditions outside Great Britain.

The horses referred to in the Question were detained on landing and were destroyed, as they were unfit to travel. They came from the Irish Republic, and the attention of the Irish Government has been drawn to this case. I am sure that this will receive due attention in a country where horses are so esteemed.

Mr. Hastings: May I ask the Prime Minister, whose fondness for horses we all so much admire, whether he appreciates the sufferings of these poor wretched beasts, and whether he has seen the bones, which I have here, of one of the horses mentioned in the Question which was suffering from very severe arthritis? Cannot something further be done to prevent this dreadful cruelty?

The Prime Minister: I agree that no opportunity should be lost in stimulating the scrutiny paid to all aspects of horse transit and horse slaughter. We will do our utmost—there is only one view in this House on this subject—by example and by precept to improve present conditions.

. . . . . .

Fowl Pest

Mr. Grimond (December 18th) asked the Minister of Agriculture to make a statement on the causes of the recent outbreak of fowl pest.

Sir T. Dugdale: The main reason for the large increase in the number of cases of fowl pest reported in recent weeks is that an outbreak occurred in a large hatchery and rearing plant near Halifax from which a considerable number of movements of stock had taken place before the presence of disease was recognised. These movements account for 129 of the 183 outbreaks that have occurred since November 28th. Of the other 54 outbreaks during this period, 33 appear to have spread from known outbreaks. Origins of the remaining 21 and of the outbreak at Halifax remain obscure, though enquiries are continuing.

. . . . . .

Slaughtered Diseased Stock (Taxed Compensation)

Mr. G. Williams (December 16th) asked the Chancellor of the Exchequer to what extent, under his regulations, compensation paid to farmers who are forced to slaughter their stock owing to foot-and-mouth disease is subject to any form of taxation; and how it is calculated.

Mr. R. A. Butler: Where animals treated for tax purposes as trading stock have to be slaughtered the compensation represents a revenue receipt and as such is liable to tax. Where, however, a production herd is dealt with on the "herd basis" in accordance with an election under Section 473 and the Twentieth Schedule, Income Tax Act, 1952, compensation would normally be brought in as a receipt for tax purposes, not at the time of payment, but as and when new animals were acquired in replacement.

. . . . . .

Dairy Cattle Population (Scotland)

Mr. Hamilton (December 17th) asked the Secretary of State for Scotland what steps he intends to take to arrest the decline in the number of dairy cattle in Scotland.

Mr. J. Stuart: While there has been a fall of about 2½ per cent. in the numbers of dairy cattle shown in the returns for June and September this year as compared with the numbers shown in the corresponding returns in 1951, I am glad to say that this has been accompanied by an increase of approximately the same percentage in the gallonage of milk produced for sale. While I shall keep the position under review, I do not think that any special steps are necessary at this time.

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Fowl Population (Scotland)

Mr. Hamilton (December 17th) asked the Secretary of State for Scotland if he is aware of the decrease in the number of fowls six months old and over in Scotland; and what steps he is taking to arrest this fall.

Mr. J. Stuart: While the number of fowls six months old and over shows a decrease of approximately 2 per cent. in September this year as compared with the corresponding figure last year, it also shows an increase of 3 per cent. on the June figure of this year. The numbers of birds under six months also, in both June and September this year, are higher than the corresponding figures for last year. In the circumstances I do not think that any special steps need to be taken. The decrease in the total number of fowls is less than 1 per cent.

XUM

NOTES AND NEWS

Diary of Events

Jan. 1st.—Meeting of the Central Veterinary Society at the Royal Veterinary College, N.W.1., 6 p.m.

Jan. 2nd.—Meeting of the Association of Veterinary Teachers and Research Workers, at the Royal Veterinary College, N.W.1, 11 a.m.

Jan. 7th.—Meetings of the Editorial Committee, B.V.A., at 36, Gordon Square: Executive 2 p.m.; main 3 p.m. (*N.B. Brought forward from the second to the first Wednesday in the month.*)

Jan. 7th.—Meeting of the R.A.V.C. Division, B.V.A., in the Lecture Theatre of the Zoological Society's Gardens, Regent's Park, London, 12 noon.

Jan. 9th, 1953.—Dumfries and Galloway Division, B.V.A., Ladies' Guild: Annual Dance in aid of the V.V.B.F., at Dumfries (Cairndale Hotel). (See Notice.)

Feb. 27th.—Annual Ball of the Veterinary Society, Faculty of Veterinary Science, The University, Liverpool, to be held in the Students' Union from 8.0 p.m. to 2.0 a.m.

Council and Committee Meetings of the B.V.A.

The following arrangements for the Council and Committee meetings of the B.V.A. in January, April and July of 1953, have been made by Council B.V.A.:—

January 14th, 15th and 16th in London.
April 29th, 30th and May 1st in Edinburgh.
July 29th, 30th and 31st in London.

The times of the various meetings will be published in due course.

The next quarterly meetings will be held in London on January 14th, 15th and 16th, 1953, in the following order:—

Wednesday, January 14th.—10 a.m., Home Appointments Committee; 11.30, Parliamentary and Public Relations Committee; 2 p.m., Organising Committee; 4 p.m. Provisional Committee.

Thursday, January 15th.—10 a.m., Veterinary State Medicine Committee; 12 noon, Finance Sub-committee; 2.30 p.m., General Purposes and Finance Committee.

Friday, January 16th, at the Connaught Rooms:

9.30 a.m.—Special Meeting of Council to deal with: (1) New premises for the Association; (2) Report of the Departmental Committee on Licences under Section 7 of the Veterinary Surgeon's Act, 1948.

11 a.m.—Ordinary Meeting of Council.

R.C.V.S. Council and Committee Meetings

The next series of meetings will be held in London on February 4th, 5th and 6th (Council).

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R.C.V.S. OBITUARY

Fisher, O. Sarony, o.b.e., Lieut.-Colonel late R.A.V.C. (R.O.), Home Wood, Loudwater Village, Rickmansworth, Herts. Graduated London, December 12th, 1899. Died July 25th, 1952. (Notification just received.)

* * * * *

R.C.V.S. OBITUARY

FUNERAL OF MR. R. GLAVE SAUNDERS

Service in Exeter Cathedral

Leaders in the civic life of Exeter, representatives of the many organisations with which he was connected and of the veterinary profession, of which he was a distinguished member, attended the memorial service held in Exeter Cathedral on December 15th for Mr. Rowland Glave Saunders, c.b.e., m.r.c.v.s., who was Sheriff and war-time Mayor of Exeter for six successive terms, as was recorded in the obituary notice published in our issue of last week. The Cathedral was beautifully decorated with flowers.

The service, with Mr. Howard Stephens at the organ, was conducted by the Rev. Geoffrey Milroy. Prayers were led by Dr. S. C. Carpenter, who was Dean of Exeter during Mr. Glave Saunders's Mayoralty, and the lesson was read by Chancellor D. McLaren. Other clergy taking part were the Bishop of Crediton (the Rt. Rev. W. F. Surtees), the Archdeacon of Totnes (Ven. E. F. Hall), the Archdeacon of Exeter (Ven. W. A. E. Westall), Preb. R. L. Collins, and Preb. R. C. B. Llewellyn. The Dean (the Very Rev. A. Ross Wallace) was unable to attend, having only recently returned from hospital after an operation.

Cremation at Plymouth followed the service.

The immediate mourners were the widow; Mrs. W. Richard (Bristol), sister-in-law; Mr. and Mrs. Harold Barson (Sidcup) and Mr. and Mrs. Alan Hayward (Blagdon, Bristol), nephews and nieces; Mr. and Mrs. Leonard Ellis (Haldon), cousins; Major and Mrs. O. Botley (Exmouth), the Misses F. Squires and F. Henry, Mrs. E. Franklin, Mrs. M. D. Seymour and Mrs. K. Cooper (household staff), and Mr. H. J. Sawyer (Exmouth).

Also present were the Mayor of Exeter (Mr. R. Wayland Smith), the Sheriff (Mr. A. H. Roberts), the Town Clerk (Mr. C. J. Newman), the ex-Mayor (Alderman Fred Cottey) and ex-Mayoress (Mrs. Cottey), the ex-Sheriff (Alderman W. H. C. Bishop), the following ex-Mayors and ex-Mayoresses: Dr. Ransom Pickard (and representing the University College of the south-west), Mrs. A. Anstey, Mrs. Rodda, Mr. Charles Warren, Mr. W. O. Wills, and Mr. F. H. Tarr (and representing Mrs. Tarr), Alderman Vincent Thompson, Alderman and Mrs. W. T. Slader, Mrs. Michelmore (and representing Major-General W. G. Michelmore), Mrs. Brockland (representing Alderman A. E. Brock, Deputy Mayor and past Mayor).

Aldermen Sir Arthur C. Reed, A. W. C. Browning, W. T. Baker, Councillors Mrs. M. Nichols, C. Woodland, W. J. Greenslade (and representing Alderman G. J. Greenslade, past Sheriff), W. J. Hallett (and representing Councillor J. B. Martin), H. T. Ackroyd, J. Coombes, P. C. Western, S. J. Page, N. S. Ruddick, H. J. Kerswell (and representing T. Knapman and Co.); with Mrs. Edgar Brewer, Mrs. Renie Hodge, and Miss S. Y. Mathias (Exeter Education Committee).

Messrs. H. C. Haley (City Treasurer), J. Brierley (City Engineer and Surveyor), H. B. Rowe (City Architect), G. A. Tue (Director of Education), Dr. J. H. Whittles (Deputy M.O.H., and representing Dr. E. D. Irvine, M.O.H.), the Chief Constable (Mr. A. E. Rowsell), Chief Fire Officer S. F. Willey and Mr. H. C. Shackell (chief clerk), Dr. R. Churchill Blackie (curator, City Museum), Messrs. W. W. Needham (city valuer), G. W. J. Kerslake (chief inspector, Weights and Measures), E. A. Ash (City Marshal), A. E. Bonham (former chief sanitary surveyor), J. Bennett (former city architect), S. Willcocks (late engineer, Digby Hospital), H. J. Hooper (farm bailiff, Digby's), Mace-sergt. C. M. Tozer (representing Guildhall staff).

Representing the city magistrates were Mrs. C. E. W. Birkett, Mrs. Griffith Morgan, Mrs. W. H. Goddard, Miss E. Hopkinson, Messrs. Kenneth Rowe and W. J. B. Soper. Representing the University College of the south-west: Sir Thomas Taylor (Principal), Messrs. W. J. Kindell (accountant), C. H. Hawke (chief clerk, and representing the Acting Registrar), A. K. Woodbridge (former Registrar).

The President of British Veterinary Association was represented by Mr. G. Atkinson, superintending veterinary officer, Ministry of Agriculture and Fisheries, and the Western Counties V.A. by Mr. R. B. Nelder. Captain D. M. Inman represented the Devonshire Regiment. There was a very large general company, and representatives were present from the Cathedral, the R.S.P.C.A., Exeter Theatre Royal and Amateur Operatic Society, Exeter W.V.S., Exeter Division, British Red Cross Society, Welfare Associations and various clubs.

* * * * *

LEGAL NOTES

Successful Rugby Prosecution for Illegal Practice

In its issue of December 12th the *Rugby Advertiser* records that at Rugby Petty Sessions Frederick James Smith, The Kennels, Lower Hillmorton, Rugby, was summoned for two offences under the Veterinary Surgeons Act, 1948. He was accused of practising veterinary surgery when not registered in the Register of Veterinary Surgeons or in the Supplementary Veterinary Register by treating a dog at 4, Oval Road, the property of A. L. Hemsley, on or about June 22nd and June 24th.

Smith, who was represented by Mr. J. Prime, pleaded guilty in each case.

Prosecuting, Mr. J. M. Johns said that Smith's offence was that he had given a dog treatment of a nature that only a veterinary surgeon was entitled to give. Mr. Smith was not authorised as he was not a registered member of the Royal College of Veterinary Surgeons, neither was his name on the supplementary list. The proceedings were not being brought to try to effect a "closed shop" for members of the profession, but it was for

the protection of animals against the possible consequences of being given treatment by unqualified persons.

There was no suggestion that Smith's treatment was wrong in itself. He had a long experience of treating animals, especially dogs. In this case the dog was ill at 4, Oval Road, on June 22nd, and Mr. Hemsley called in Smith to give treatment. Later the dog was taken to a veterinary surgeon and was destroyed after "hard pad" had been diagnosed. There was no suggestion that its life might have been saved if taken to a veterinary surgeon in the first place.

Mr. Prime commented that Smith had a long experience with animals, and had been well known in the district for 35 years. For the past 25 years he had been mainly concerned with treating cats and dogs. It was not until 1948 that his activities had become wrongful. Smith had applied to have his name put on the supplementary list. This had been refused and Smith had been advised to appeal. Normally he would have done so but he was upset by a bereavement. When reference was made to him as a "vet" Smith would immediately correct the impression.

The police had at times called upon Smith for his services, which he had given, and they obviously knew he was not a veterinary surgeon. Smith was no longer treating animals himself.

Smith was fined £4 and had to pay £1 towards the advocate's fee.

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ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

ANTHRAX:

Ches.—Lawton Gate Farm, Lawton; The Kennels, Park View, Combermere, Nantwich (Dec. 15th).

Derbys.—Hoe Grange Farm, Brassington, Derby (Dec. 15th).

Devons.—Moxhayes Farm, Yarcombe, Honiton (Dec. 12th).

Dorset.—Farnham Farm, Farnham, Blandford (Dec. 13th).

Essex.—Lynn Regis, Lodge Lane, Collier Row, Romford (Dec. 12th); Fenn Road Allotments, Halstead (Dec. 15th).

Hants.—Nichols Corner, Barrley, Lyndhurst (Dec. 15th).

Kent.—Saunders Cottage, Riding Lane, Hildenborough, Tonbridge (Dec. 13th).

Lancs.—Bury Meadows Farm, Oswaldtwistle, Accrington (Dec. 15th).

Somerset.—Charlton Farm, Wraxall, Bristol (Dec. 12th); Moss Farm, Ruishton, Taunton; Batch Farm, Street (Dec. 13th); Hillside Farm, Mudford, Yeovil (Dec. 15th).

Suffolk.—Lodge Farm, Mendlesham, Stowmarket (Dec. 15th).

Sussex.—Piggeries, Cairo Avenue, Peacehaven (Dec. 12th).

Westmorland.—Broadgate, Hugill, Windermere (Dec. 12th); Green Dragon Farm, Burton, Carnforth; Lupton Hall, Lupton, Kirkby Lonsdale, Carnforth (Dec. 13th).

Yorks.—Helm Farm, Battyeford, Mirfield (Dec. 15th).

FOWL PEST:

Beds.—20, High Street, Houghton Conquest, Bedford (Dec. 13th).

Bucks.—Poyle Farm, Poyle Lane, Burnham (Dec. 12th).

Devons.—Newholme, South Milton, Kingsbridge (Dec. 12th).

Glamorgans.—Nant Goch, Llydcoed, Aberdare (Dec. 12th); 10, Lon-ger-y-coed, Cymgwyn, Swansea (Dec. 15th).

Isle of Ely.—55, Newgate Street, Doddington, March (Dec. 12th); Crecys Poultry Farm, Wimblington, March (Dec. 14th); 13, Primrose Hill, Doddington, March; 2, Primrose Hill, Doddington, March; 9, Primrose Hill, Doddington, March (Dec. 15th).

Kent.—Dylers Farm, Hawkhurst (Dec. 13th).

Lancs.—Shawcloogh Farm, Waterfoot, Rossendale (Dec. 12th); Shirfin North Farm, Rising Bridge, Accrington; Greenbank Farm, Forton, Preston (Dec. 13th); 1, Paddock Dene, Sharneyford, Bacup; Scar End Farm, Wain, Bacup; Howarth Fold Farm, Burnley (Dec. 14th); Size House Field, Haslingden, Rossendale; Roseacre, Tag Lane, Ingol, Preston (Dec. 15th).

Lincs.—South Grove Poultry Farm, Helpringham, Sleaford; The Gables, Sutton St. James, Spalding (Dec. 12th); the Chestnut, Sutton St. James, Spalding (Dec. 13th); Chapel Gate, Sutton St. James, Spalding (Dec. 14th).

London.—16, Long Drive, East Acton, London, W.3 (Dec. 14th).

Norfolk.—Yew House, Town Street, Upwell, Wisbech (Dec. 12th); Two-ways, Town Street, Upwell, Wisbech; Dorken, Pown Street, Upwell, Wisbech (Dec. 15th).

Notts.—Manor Farm, Clipston-on-the-Wold, Plumtree (Dec. 12th); Hall Farm, Clipston-on-the-Wold, Plumtree; Glebe Farm, Clipstone, Mansfield (Dec. 13th); 19, Scrimshire Lane, Cotgrave, Nottingham (Dec. 14th).

Radnors.—Church Cottage, Beguily, Knighton (Dec. 15th).

Suffolk.—Hither House, Holbrook, Ipswich (Dec. 12th).

Wilts.—The Battery House, Rowden, Chippenham (Dec. 13th).

Worcs.—Box Cot, Five Ways, Bourneheath, Bromsgrove (Dec. 12th).

Yorks.—60, Black Queen Street, Ravensthorpe, Dewsbury (Dec. 12th); Upper Hazelhurst Farm, Wainstalls, Halifax; Brookfield Road Allotments, Conisborough, Doncaster; The Vicarage, North Grimston, Malton (Dec. 13th); Styles Farm, Sowerby Bridge; Manor House, Whitwood, Normanton (Dec. 14th); Church Farm, Robert Town, Liversedge; Lower House Farm, Paythorne, Gisbury, Clitheroe (Dec. 15th).

SWINE FEVER:

Ches.—Grange Farm, Raby, Wirral (Dec. 16th); Manor Farm, Wilkwsley, Burleydam, Nantwich (Dec. 17th).

Essex.—14, Accommodation Road, Boxted, Colchester (Dec. 12th); Sheepcote Farm, Great Henny, Sudbury; Hassocks Farm, East Bergholt, Colchester; Abbotts Hall, Great Wigborough, Colchester (Dec. 15th); Severalls Mental Hospital, Cuckoo Farm, Mile End, Colchester (Dec. 17th).

Flints.—Clwyd Pig Farm, Rhuddlan (Dec. 15th).

Herts.—Hampton Hall Farm, Moor Lane, Rickmansworth (Dec. 12th).

Lincs.—The Hollies, South Cockerington, Louth (Dec. 12th).

Norfolk.—16, Victoria Road, Diss (Dec. 16th).

Rutland.—Woodland Lane Farm, Braunston, Oakham (Dec. 12th).

Suffolk.—Roundwood Farm, Sutton, Ipswich (Dec. 15th); Sandpits Farm, Walsham-le-Willows, Bury St. Edmunds (Dec. 16th).

Yorks.—Harrison's Yard, Bromley, Leeds (Dec. 12th); Gate Eel Farm, Dacre Banks, Summerbridge, Harrogate (Dec. 13th).

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DEATH FROM PSITTACOSIS

JURY URGE PROTECTIVE MEASURES

At Birmingham on December 19th a coroner's jury found that psittacosis was the cause of the death of the manager of a pets' corner in a department store. The jury added two riders to their verdict. The first urged that all persons employed in the handling of birds and animals should wear protective clothing, and the other that no bird of the parrot family should be sold to the public or allowed in the country unless guaranteed by an expert to be free of infection.

The inquest was on Frederick Northfield Clark, aged 57, of Maurice Road, Kings Heath, Birmingham, who died in hospital on December 4th.

Mrs. Doris Irene Clark said that during the week beginning November 16th her husband collected a consignment of birds from Australia at London Airport. He became ill and went to bed on November 23rd.

Mr. Joseph Sidney Coughlan, merchandise manager at the stores where Mr. Clark worked, said that the ban on the import of parrots and cockatoos, which had operated since 1930, was lifted early this year. A number of birds which Mr. Clark went to collect at London Airport were dead on arrival and more had died since. Mr. Clark attributed the deaths to the length of time taken on the journey from Australia. No special arrangements had been made to examine the birds, in addition to the routine veterinary inspection of livestock in the pets' corner, which took place twice a week.

Mrs. Hilda Barnes, assistant to Mr. Clark at the store, said that there were 190 birds in the consignment from Australia. Twenty-two were dead on arrival, and altogether 58 had died. Mr. Clark was bitten by a cockatoo on November 17th. She had been bitten twice, but had not gone to hospital.

Dr. J. C. N. Westwood, of the Central Public Health Laboratory, London, said that from samples of blood and tissue from Mr. Clark's body he had isolated the psittacosis virus. Since the ban had been raised there had been a number of cases of psittacosis known to be associated with infected parrots. It was possible for the disease to be transmitted by a bite, but the most common way was by the inhalation of infected dust from the birds. In two dead parrots sent to him from Birmingham after Mr. Clark's death he had found evidence of psittacosis.

Dr. Kenneth Walton, pathologist at the Queen Elizabeth Hospital, Birmingham, who conducted a *post-mortem* examination, said that

death was caused by pneumonia due to the psittacosis virus. Psittacosis could be transmitted by other birds, such as pigeons and budgerigars, but the virus carried by British birds was not so prone to cause serious disease as that carried by foreign birds.

Addressing the jury, the Coroner, Mr. G. Billington, said that steps had already been taken to ensure that no more of this particular consignment of birds should reach the public.

The jury returned a verdict that death was due to psittacosis from imported birds as a direct result of Mr. Clark's employment.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

VETERINARY SERVICE IN NEW ZEALAND

Sir,—I would like to make certain comments on Mr. Stewart's communication to you as quoted in *The Veterinary Record* of October 11th, 1952.

I am writing as an individual and not as a member of the Veterinary Services Council.

The communication contains many inaccuracies, some of little importance but others of a nature to make Mr. Stewart's statement misleading. I will not quote Mr. Stewart's words, but only the paragraph, to avoid writing at too great length.

Paragraph 1.—The Veterinary Services Council consists of 10 members and not 13.

Four of the Council are veterinary surgeons and not five.

The New Zealand Veterinary Association is represented on the Council by a member selected by secret ballot from the body of the Association, which includes private practitioners.

Paragraph 2.—The club veterinarian is paid a salary that starts at £800 per annum after graduation and rises automatically for every year of graduation (not employment) to £1,100 after five years; the rate thereafter is by promotion. There are a number of men receiving more than £1,200.

The Council has no power to move a veterinary surgeon to another club. The veterinary surgeon may terminate his contract at three months' notice and if he wishes to do so, apply to any club for employment.

The contract is between the individual club and the individual veterinarian and cannot be interfered with by the Council.

If a veterinary surgeon makes more than his salary, the extra is not "credited to the club movement," it is retained by the club employing him and spent on such items as housing, dispensaries and equipment to increase the efficiency of the service. Under no circumstances do members of the club receive dividends except as improved service.

"The Government subsidy amounts to £400 per club per annum," should read "The Veterinary Services Council subsidy amounted to £400 per annum for each veterinarian employed by the club," only half of this subsidy is obtained from the Government, the other half being levied by farmer-controlled boards on exports of dairy produce, meat and wool; in other words, it is obtained directly from the farming community. The "typical club" quoted is completely atypical. The clubs roughly can be divided into three types:—

(*a*) Those run by co-operative dairy companies whose suppliers have balloted at an annual general meeting to have a veterinary service and to have an agreed amount deducted monthly from their monthly cheque, the amount being set at a fraction of a penny for each pound of butterfat supplied. A typical sum is 0·05d. There is a small visit fee, usually about 7s. 6d. and no mileage.

The suppliers thus pay in proportion to the dairy production of their herd.

(*b*) Clubs in dairying districts, but not connected with the dairy companies, started by a group of farmers with membership on a completely voluntary basis, and the subscription based on the number of animals owned, and with a minimum subscription.

Typical charges would be 2s. per cow per annum with a minimum of £4 and extra charged for large numbers of sheep. A visit fee of 7s. 6d. and no mileage. Average membership of such a club would be about 200 for each veterinarian employed, and average miles run per visit would be about 11. The average subscription would be about £6 to £7 excluding visit fees.

Again the members pay in proportion to the size of their herds.

(*c*) Clubs in predominantly sheep and beef areas.

The charges in these vary considerably as in such areas distances are great and the roads very bad.

Combinations of a, b and c are sometimes found within one club.

Paragraph 3.—The words "original Labour sponsors" are only technically correct.

The Veterinary Services Act was conceived and gestated by a number of boards and bodies run by farmers, in consultation with experienced veterinary surgeons in executive positions, all these people being deeply concerned at the paucity of veterinary service in the Dominion. Classifying such people as Labour with a capital L would raise a hearty laugh from anybody knowing the political atmosphere of New Zealand.

"It is the intention of the Council not to allow its policy to prove detrimental to the expansion of the club movement throughout the Dominion."

Realising that this sentence just did not make sense, I have read right through the first annual report of the V.S.C. for the year ended March 31st, 1948, and cannot find any sentence in it even remotely resembling the one quoted.

The percentage of resignations, as shown in the last annual report of the V.S.C., is not high.

Paragraph 4.—Quite naturally the B.V.A. found itself unable to assist in the exchange of the veterinarians, for as there is nothing comparable to the V.S.C. in Great Britain, what body would find the money to cover the British share of the finance? One would hardly expect individual practitioners to do so.

The words "other European Countries, particularly Holland" are misleading.

Four Dutch graduates were appointed in 1951, in Holland, one of whom has since returned home. The only other veterinarians employed who are not graduates of Commonwealth schools are one or two men who found their own way into the Dominion, and were registered here.

Ex-Servicemen graduating on rehabilitation bursaries are not at the disposal of the council unless they wish to be so.

Paragraph 5.—I agree that there should be a veterinary school in New Zealand, but I do not agree that the present lack of one is "an amazing omission." It does not amaze me at all.

Before a Government will move in such a matter there must be a demand from the general community; only recently has that demand been really evident, and it would not even now be present if it were not for the good work done by Club practitioners and the consequent growth of clubs, sponsored by a minority of enlightened farmers.

The result is a rapid education of the majority, who may be able to afford to pay private practitioners, but who in the past have been of the opinion that they could very well manage without any veterinary service at all.

I do hope, Sir, that before too freely using the word "Socialised" and "Socialism" in connection with the growth of veterinary service in New Zealand, you take a further and more penetrating look at the evidence.

Club veterinarians are employed directly by a local group of farmers, and are not employees of the State. The comparatively small sum provided by the Government is a recognition of the fact that full veterinary coverage is necessary for the purpose of disease control, and is paid to reduce the expenses of those people who finance the club.

I am aware that such moneys, in the form of L.V.I. fees, are paid in Great Britain to veterinarians, but is it not a fact that many of the L.V.I. fees are paid, not to the men who earn them, but to their employers?—Yours faithfully, JOHN MACDONALD, B.V.SC., M.R.C.V.S., P.O. Box 23, Te Awamutu, New Zealand. *November 25th*, 1952.

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PICRIC ACID IN VETERINARY PRACTICE

Sir,—During my practice in Pakistan I was impressed by the efficacy of a one per cent. solution of picric acid used as an antiseptic in the treatment of acute and chronic inflammatory wounds, and found no difficulty in overcoming the disadvantage of staining by the use of a potassium sulphate wash. I have also found that a one to five per cent. hydro-alcoholic solution of picric acid proved effective in the treatment of moist eczema.

The use of picric, however, does not appear general and I wonder whether this is due to the difficulties of storing this material owing to its explosive nature, or whether other disadvantages exist. Perhaps some of your readers have had experience along these lines.—Yours faithfully, S. ASGHAR (*Final Year Student*), Royal Veterinary College, Streatley, Berks. *December 16th*, 1952.